Report to the Colville National Forest on the Results of the Quartzite Planning Area Fire History Research

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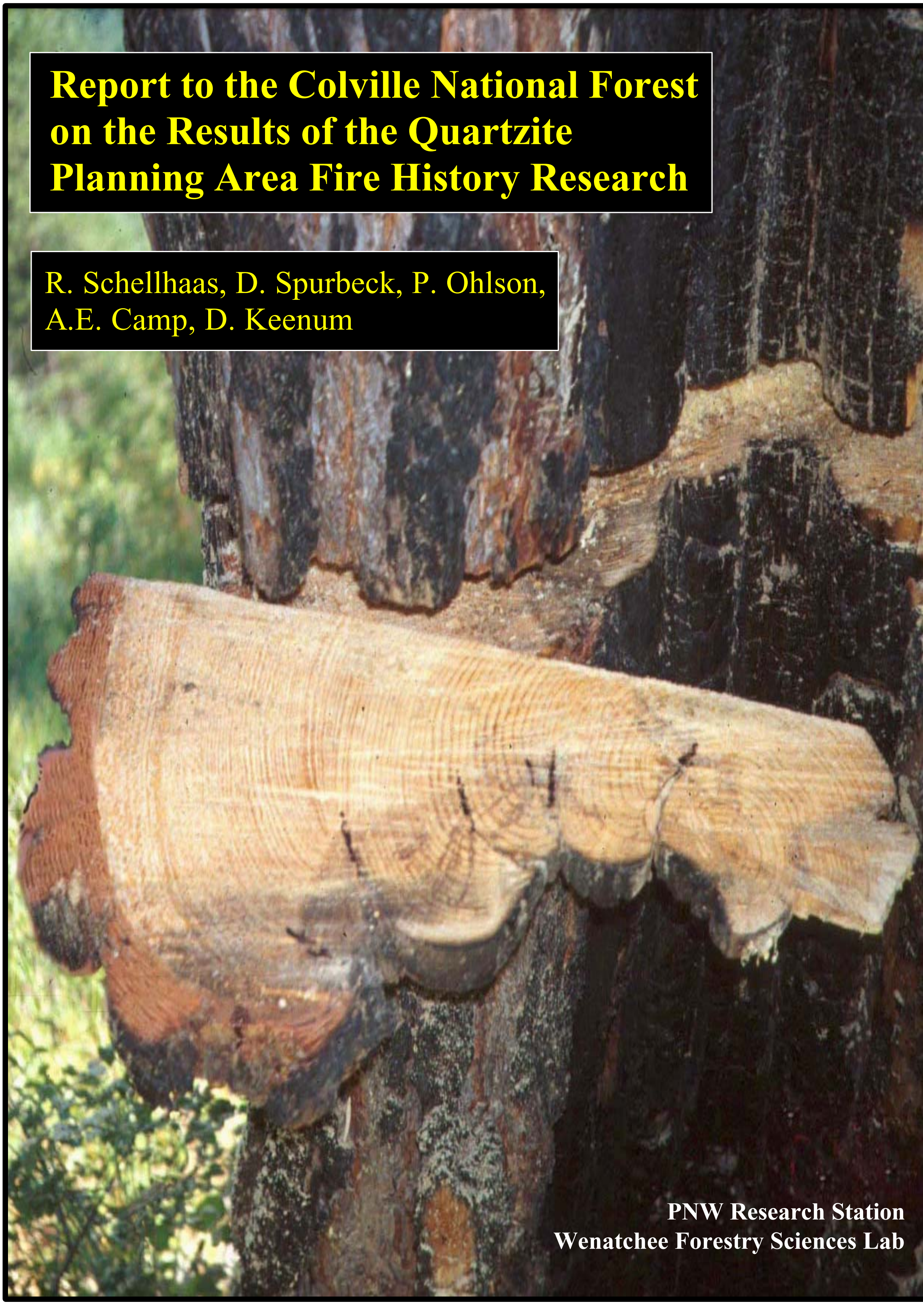

PNW Research Station
Wenatchee Forestry Sciences Lab

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ABSTRACT

A total of 1,301 individual fire scars were cross dated from 142 fire scar samples on 7,669 acres of forest service land within the Quartzite planning area on the Colville National Forest. The earliest fire discovered was in 1384; however, our effective fire history dates from 1671. Mean fire frequency interval (MFFI) within polygons was 8.3 years during the pre-settlement era (1670-1885) and 5.9 years during the settlement period (1886-1920). These fire frequencies are characteristic of a high frequency, low severity fire regime. The longest period between successive fires was 25 years prior to settlement era and 15 years during the settlement period. Fire frequency increased and fire size decreased during the settlement era. Mean fire size within polygons 1-7 was 1,076 acres during the pre-settlement period and 300 acres during the settlement era.

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1. INTRODUCTION

The Quartzite Project Area is 23,296 acres in size, with 10,483 acres under Forest Service ownership. The project area is located in the northeast corner of Washington State, 22 miles south of Colville and directly east of the town of Chewelah. The area is classified as 81% warm, dry PSME /forb-shrub, 11% cool mesic PSME, ABGR/forb-shrub, 7% cool mesic THPL, TSHE/ forb-shrub, and 1% cold, mesic ABLA2/ forb-shrub.

The fire history of an area is a function of forest type, topography, microclimate, ignition sources and past disturbance history. Knowledge of the fire history provides some insight into the kinds and patterns of vegetation that likely existed and provides land managers with information that can be used to create, restore, and maintain sustainable vegetation patterns. The inherent fire disturbance regime for an area is an important reference point for assessing changes in vegetation patterns and the concomitant risks of current vegetation patterns to catastrophic disturbances.

Research on the Wenatchee and Okanogan National Forests has shown that fire regimes, stand structure, and species compositions in ponderosa pine, Douglas-fir and grand fir series forests have dramatically changed as inherent disturbance regimes have been altered through livestock grazing, roading, and fire suppression (Everett et al. 1996, Wright 1996, Everett et al. 1997, Everett et al. 2000). Forests in these vegetation series have progressed farther along climatic successional trajectories. Fire regimes in these forests have changed from frequent low-severity fires to a less frequent, but high-severity (stand replacement) fire regime.

Changes in fire regimes as well as changes in forest structures and compositions also alter characteristic snag and log densities in these forest types. Snag and log targets based on uncharacteristic forest development patterns are likely less sustainable than targets derived from inherent disturbance processes. Knowledge of these disturbance regimes help land managers monitor ecosystem integrity and make landscape-level decisions.

2. METHODOLOGY

2.2 Field Methods for Master Chronology and Fire History

Data for this fire history were collected in early summer, 2000 on 7,669 acres of the 10,483 acres of the Quartzite Planning Area within the boundary of the Colville National Forest (figure 1). These acres were intensively searched for evidence of past fires, including fire-scarred trees, snags, logs, and stumps. On living fire-scarred trees and snags, wedges containing the fire scars were cut using the method described by Arno and Sneck (1977). Samples from logs and stumps were sectioned to ensure collection of the maximum number of fire scar events. Whenever possible, multiple samples in close proximity were collected to develop point fire frequency intervals.

Where direct evidence of past fires was scarce, locations of remnant trees (those remaining following a fire) were identified and mapped on historical and current aerial photographs. These trees were then located in the field and increment cores obtained to infer and extend the fire history record through cohort analysis (sensu Heinselmann 1973, Oliver and Larson 1996). Locations of fire-scarred samples were geo-referenced and entered into a GIS database for subsequent mapping of fire locations and extent. In all, 142 fire-scarred samples were found and an additional 50 increment cores were collected (Figure 1).

Accuracy in determining the exact year in which a fire occurred depends on developing a master chronology, or time series of tree-ring widths in which the climate signal is maximized. Tree growth on dry, rocky outcrops in the Quartzite planning area is limited by available soil moisture, which changes in response to annual precipitation. Trees growing on these harsh sites have narrow annual growth rings in dry years and wide rings in wet years. 23 of these climatically sensitive trees were cored to develop a master chronology for dating fire-scars.

2.3 Laboratory Preparation and Analysis

Following data collection and geo-referencing of samples, the sampled area was divided into 8 polygons ranging in size from 20 to 2,623 acres (Figure 1). These polygons were developed along topographical features such as ridgelines and stream channels. These polygons serve as the basis for calculating area fire frequencies.

Increment cores from climatically-sensitive trees were used to develop a skeleton plot of signature wet and dry years following procedures described by Stokes and Smiley (1968). The skeleton plot was used to construct a 400 year master chronology. Signature years and recognizable patterns of years were used to cross-date fire scars on each sample and assign the correct calendar year to each fire scar (Madany et al 1982, Dietrich and Swetnam 1984, Brown and Swetnam 1994, Grissino-Mayer 1995a). Cross-dating was facilitated by developing a list of marker years (Yamaguchi 1991) that could be readily identified on many of the fire scar sections.

Wedges from fire-scarred trees and snags were stored in a cool, dry location. Each wedge was sanded with a succession of sandpapers, ending with either a 320 or 400 grit. Some of the sections cut from western larch snags and logs were partially rotten and required extensive gluing and re-construction before they could be sanded and fire scars dated. Fire scars from live trees and dead wood were dated by visually comparing ring patterns with those in the master chronology. A total of 1301 individual fires were cross dated from the 142 scar samples.

Once each fire scar was assigned a date, these data were analyzed using the FHX2 software package (Grissino-Mayer 1995b). Fire intervals were computed using the composite, Weibull median, and point-frequency methods. Fire chronologies were assembled for each polygon and for the planning area. Data for each polygon were further stratified into two time periods, pre-settlement (1671 to 1885) and pre-suppression era settlement (1886-1920).

Fire extent maps were completed for individual fire years using data from the geo-referenced locations of fire-scarred samples and tree cores (after Agee et al. 1986). Tree cores located within or near the established fire perimeter that exhibited aberrant ring patterns were used to reinforce fire boundary locations. Historical fire boundaries were developed using criteria similar to those used by Hemstrom and Franklin (1982). As did they, we made the following assumptions:

1. A fire starting within the general area of where the samples were collected would spread until encountering a topographic or fuel barrier.
2. Fire spread was in an uphill direction.

3. Fire boundaries were conservatively estimated; perimeters were not extended beyond the evidence of fire scar or cohort data except by rules 1 and 2.

Two methods were used to map fire extent. The first was based primarily on fire scars, supported by pith dates from scar sample cross sections and remnant tree cores that corresponded with established fire scar data (the more conservative method, shown in red on the fire year maps in the Appendix). The other method relied on fire scar dates from samples as well as pith dates and ring patterns from cores that matched known fire years (the extended method, shown in yellow on the fire year maps in the Appendix). Reported fire sizes reflect the more conservative estimate.

3. FIRE HISTORY TERMINOLOGY AND CONCEPTS

3.1 Fire Frequency

Researchers report results of fire history studies using specialized terminology. Without an understanding of fire history terms and concepts, it can be difficult to interpret the results of a study, compare results from different studies, or develop management options based on study results.

Fire interval (FI), fire-free interval (FFI), and fire return interval (FRI) are three synonymous terms that refer to the number of years between two successive fire events in a given area. The arithmetic average (mean) of all fire intervals in a given area over a given time period is referred to as the mean fire return interval (MFRI) or mean fire frequency interval (MFFI). This metric is the one that has commonly been used to characterize fire regimes and is based on an underlying assumption, not necessarily correct, that fire return intervals are distributed normally. Grissino-Mayer (1995a) suggests that the Weibull median fire frequency interval (WMFFI) is a more accurate metric for characterizing fire regimes when fire frequency distributions are skewed (the distribution curve is not normal (bell-shaped), but has one tail longer than the other). For this study, we have chosen to follow the terminology used in the fire history analysis software developed by Grissino-Mayer (1995b). We report both MFFI and WMFFI when data were sufficient to calculate the latter. Where data were not sufficient to calculate the WMFFI statistic, we report only the MFFI.

3.2 Point vs Area Estimations of Fire Frequency

Another concept necessary to fully comprehend and compare reconstructed fire histories is the difference between point-based and area-based MFFIs (or WMFFIs). The following definitions of point and area frequencies were taken from Agee (1993). A point frequency is the mean fire interval at a single point (an individual scarred tree) on the landscape. In practice, point frequencies are usually expanded to include data from several proximate scarred trees because a single tree may not always record every fire. Agee (pers. comm.) recommends sampling 3 to 5 scarred trees in close proximity (within < 3 acres) to derive an accurate estimate of fire frequency at an individual location. An area frequency represents the mean interval between fires that burned some portion of, but not necessarily the entire, sampled area. Successive fires within an area may overlap somewhat, entirely, or not at all. Point-based estimates of MFFIs are generally larger (longer periods between successive fires) than those derived from area estimates (Kilgore and Taylor 1979).

Ecological (fire effects) implications can be confounded by reporting an MFFI but neglecting to mention if the estimate is based on data from a single point or from across a large landscape. Knowing the size of the area on which the estimated MFFI is based is critical; as the size of a sampled area increases, MFFIs generally decrease. In fact, there are existing studies that report MFFIs of less than 2 years (Kilgore and Tayor 1979, Dieterich 1980). These estimates are based on fire scars collected across very large landscapes. Estimates of fire frequency taken from samples collected across large landscapes are generally not suitable for inferring ecological processes based on the effects of recurring fires. Actual fire frequency at any specific point on the large landscapes studied and reported on is much greater than 2 years. Area frequencies reflect the incidence of fire somewhere, but usually not everywhere, within the sampled area. Variability around the MFFI within an area becomes more pronounced as the sampled area increases in size or heterogeneity, with some areas experiencing fire frequencies much higher or lower than the mean. In contrast, point-based estimates of fire frequency, especially when corroborated by multiple scar samples taken from several proximate trees, provide specific information about the periodicity of recurring fires - and the effects of those fires - at a known place on the landscape.

4. RESULTS AND DISCUSSION

The earliest fire we were able to document within the Quartzite Planning Area occurred in 1384; we also documented some fires from the fifteenth and sixteenth centuries. Although we were able to document some very old fire events, the number of surviving scar samples from the 14th,15th and 16th centuries was too small to reliably infer fire frequencies or sizes for that time period.

The number and quality of the fire scar samples we collected enabled us to reconstruct the fire history of much of the sampled portion of the Quartzite Planning Area back to 1671. Our fire history analyses do not include fires that occurred after 1920, although several fires burned portions of the Quartzite planning area after that date. We chose 1920 as the cutoff date for our fire history analysis because of an abrupt change in fire frequency and size after that date (Figures 2 and 3). These changes have been documented across the West and likely result from a combination of factors, including livestock grazing, roading, and active fire suppression, that significantly altered inherent fire regimes. We believe that including fires that occurred after 1920 would bias our fire history analysis, even though we found scar evidence for the occurrence of fires in the area into the mid-1980s.

For the sampled portion of the Quartzite area as a whole, the MFFI for the pre-settlement period was 2.8 years. The WMFFI was 2.5 years. As previously described, these numbers reflect that, on average, there was a fire **somewhere** within the sampled area every 2 to 3 years. For the period of active settlement the MFFI and WMFFI were 2.3 and 2.1 years respectively. The positively skewed distribution of our data suggest that the WMFFI statistic more accurately reflects fire return intervals for the Quartzite planning area; however, the two values are quite similar.

The estimated number of acres burned within the sampled portion of the area each year since 1671 are shown in Figure 2. Total estimated area burned each decade is shown in Figure 3.

Although it is interesting to know that fires burned somewhere within the planning area every 2 to 3 years, knowledge of the frequency of disturbance at smaller scales is of more use from a management perspective. Therefore, we reconstructed the fire histories for each of the 8 polygons. Table 1 contains the results of this analysis and includes the point, MFFI and WMFFI statistics whenever possible. In some instances we did not have enough data to compute the WMFFI statistic, but as both statistics do not differ to any great extent, use of the MFFI statistic for management decisions is appropriate. The following comparisons are made using only the MFFI metric. Pre-settlement MFFIs ranged from 7.0 years in Polygon 1 (Eagle mountain) to 11.3 years in Polygon 7 (Woodward North). The average percent a polygon burned in a single fire event (Table 2) ranged from 19% in Polygon 2 (Jay Gould ridge) to 59% in Polygon 7 (Woodward North). Average (mean) fire size within polygons 1-7 was 1,076 acres, with a range of 15 to 7,251 acres. Most fires burned across polygon boundaries and into adjacent polygons.

Figure 4 shows the 57 locations for which we derived point-based estimates of MFFI. The point-based estimates were, as expected, generally longer than the area-based estimates, ranging from 9.0 to 22.3 years (Table 3). The time periods for which point estimates of MFFI are based vary among points, reflecting differences in the quality and availability of scar samples at each point.

During the settlement period, MFFIs ranged from between 3.3 years in Polygon 1 (Eagle mountain) to 11.0 years in Polygon 6 (Woodward south). In most instances, MFFIs were lower during the settlement era as compared to the pre-settlement period. Mean fire size within polygons decreased to 192 acres during the settlement period. Most fires burned across polygon boundaries during this period as well.

Estimates of actual, as opposed to within-polygon, fire size ranged from a 15-acre fire in 1879) to a fire that burned 7,271 acres, roughly 95% of the sampled portion of the planning area, in 1882. The series of maps in the Appendix show locations and estimated sizes of fires for each of the years in which we documented fire activity within the Quartzite Planning Area. Fire sizes were conservatively estimated and typically exclude private lands within the watershed. Actual fire sizes were probably somewhat larger than our estimates.

To ascertain if topographic features historically served as firebreaks, we computed Jaccard Similarity Indices (JSI) between pairs of adjacent polygons separated by either a valley bottom or a ridgeline and between non adjacent polygons (Table 4). A higher Jaccard Similarity Index indicates that the polygons being compared shared similar fire events and thus the topographic feature separating the polygons was not effective in stopping spread of fire between the polygons. We found the highest indices for polygon's 2 and 3. These polygons are non-adjacent and separated by a ridge, indicating that this topographic barrier was not effective in halting the spread of fires between these two polygons.

We found that fire frequency varied from 1 to 23 years around the mean for area based estimates of MFFI. There was considerably more variation at individual points on the landscape (Table 3). We found minimum MFFIs of 3 years and a maximum interval of 48 years.

5. CONCLUSION

Results from this study indicate that the inherent fire regime for the Quartzite Planning Area was one of high frequency, low severity fires. The mean diameter of trees at stump height when first scarred was 5.0 inches (Table 5). This type of fire regime is also typical of the dry forest types in the ponderosa pine, Douglas-fir, and grand fir series along the eastern slopes of the Washington Cascade mountains (Everett, et. al. 2000). Low MFFI's suggest that the Quartzite Planning Area was historically dominated by species more tolerant of fire such as ponderosa pine and western larch, since even low severity fires would kill trees that were more sensitive to fire. Douglas-fir would have been a component of early forests, but since it is quite intolerant of fire when very young, it would have been restricted to areas that burned somewhat less frequently or represented in discrete cohorts that established and persisted during one of the lengthier fire free intervals. Fire free intervals greater than about 17 years could have allowed Douglas-fir to establish and grow high enough to create a fuel ladder to the overstory. Subsequent fires might then have become stand replacing in those areas (sensu Everett, et. al. 2000).

Except in Polygon 7, fire frequency was uniform across the Quartizite Planning Area. Polygon 7 had the longest MFFI and may reflect the mixed severity fire regime typical of more mesic forest types (Schellhaas et al. 2000). In many instances, the Quartzite Planning Area is out of synchrony with historic MFFIs by a factor of 10. Vegetation is connected horizontally and vertically across the landscape, predisposing this area for fires that are of greater severity than those that occurred during the past several centuries.

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TABLES

Table 1. Fire frequency summary within polygons for Quartzite planning area.

		1671 - 1885				1886 - 1920			
Polygon	**Area Name**	**Point FFI**	**Area FFI**	**Weibull Median**	**Area Range**	**Point FFI**	**Area FFI**	**Weibull Median**	**Area Range**
1	Eagle	12.4	7.0	6.9	2-13	21.6	3.3	3.4	2-4
2	Jay Gould	14.5	7.8	7.2	1-17	23.7	7.8	6.5	1-15
3	Quartzite	14.3	8.4	8.1	3-18	15.9	5.5	4.3	1-12
4	Cottonwood	14.4	5.6	4.9	1-17	22.4	5.2	5.0	3-10
5	Betts	15.4	8.8	8.6	2-15	15.4	4.7	4.7	3-7
6	Woodward S.	13.8	7.3	7.1	1-14	18.1	11.0	*nc	7-15
7	Woodward N.	18.8	11.3	10.6	3-23	24.0	7.0	*nc	7.0
8	Round Top	11.0	10.4	10.1	5-22	16.0	4.0	*nc	4.0
	Mean	**14.30**	**8.32**	**7.94**	**1-23**	**19.60**	**5.97**	*nc	**1-15**
	SD	**2.13**	**1.85**	**1.84**		**3.43**	**2.54**	*nc	
	CV	**0.15**	**0.22**	**0.23**		**0.17**	**0.43**	*nc	
1-8	**all polygons**	**14.4**	**2.8**	**2.5**	**1.0-8.0**	**19.7**	**2.3**	**2.1**	**1.0-6.0**

*nc = not calculated, available data were insufficient for calculating this statistic

Table 2. Summary of mean fire size (acres) within the polygon and mean percentage of the polygon burned for the Quartzite planning area.

	1671 - 1885				1886 - 1920			
Polygon	Acres Burned	CV	Range	% Burned	Acres Burned	CV	Range	% Burned
1 Eagle	589	0.65	18-1071	55%	254	0.80	70-435	24%
2 Jay Gould	146	1.25	26-687	19%	74	0.81	8-171	10%
3 Quartzite	165	0.81	13-434	33%	116	0.88	41-237	23%
4 Cottonwood	295	1.20	29-1050	28%	91	0.96	13-252	9%
5 Betts	675	1.25	39-2609	27%	79	0.68	12-166	4%
6 Woodward S.	423	0.62	15-717	58%	273	0.51	172-431	38%
7 Woodward N.	535	0.67	25-847	59%	459	1.17	80-837	51%
8 Round Top	*nc	*nc	*nc	*nc	*nc	*nc	*nc	*nc
Polygons 1-7	**1076**	**1.26**	**15-7271**	**14%**	**300**	**1.26**	**54-1550**	**4%**

*nc = not calculated, available data were insufficient for calculating this statistic

Table 3. Point-based estimates of fire frequency for 57 sites in the Quartzite area.

		1886 - 1920				1671 - 1885		
Point	**MFFI**	**SD**	**Max FI**	**Min FI**	**MFFI**	**SD**	**Max FI**	**Min FI**
1	26.5	16.5	43.0	10.0	9.3	3.3	13.0	3.0
2	5.0	1.0	6.0	4.0	10.2	3.7	18.0	5.0
3	10.0	9.3	26.0	4.0	11.1	5.3	23.0	5.0
5	20.0	6.0	26.0	14.0	16.3	9.3	30.0	10.0
6	19.0	12.0	31.0	7.0	13.5	0.7	14.0	13.0
7	12.7	4.0	16.0	7.0	13.3	1.7	15.0	11.0
8	37.0		37.0	37.0	14.0	6.2	26.0	4.0
9	28.0		28.0	28.0	14.5	4.5	22.0	9.0
10	14.0	0.0	14.0	14.0	14.8	3.3	19.0	9.0
11	14.0	0.0	14.0	14.0	11.0	5.3	22.0	5.0
12	11.7	3.3	14.0	7.0	14.1	8.0	30.0	5.0
13	9.3	5.2	14.0	2.0	13.5	5.5	24.0	5.0
14	14.0	0.0	14.0	14.0	14.5	2.1	17.0	13.0
15	18.0	10.0	28.0	8.0	12.4	4.4	18.0	5.0
16	28.0		28.0	28.0	17.0	8.3	36.0	3.0
17	7.5	3.6	14.0	4.0	9.0	4.9	17.0	3.0
18	32.0		32.0	32.0	13.0	4.9	19.0	4.0
19	22.5	0.5	23.0	22.0	9.9	5.5	27.0	5.0
20	16.0	12.0	28.0	4.0	11.0	5.1	22.0	5.0
21					15.9	5.5	29.0	7.0
22	10.7	5.7	18.0	4.0	13.9	7.1	29.0	5.0
23	32.0		32.0	32.0	15.4	5.0	22.0	7.0
24					16.0	7.6	29.0	5.0
25	16.0	2.0	18.0	14.0	14.1	6.1	29.0	6.0
26	10.7	7.0	20.0	3.0	11.2	3.3	17.0	6.0
27					16.3	5.7	28.0	7.0
28	7.0		7.0	7.0	20.5	13.7	41.0	13.0
29	13.0		13.0	13.0	12.0	3.5	15.0	7.0
30	17.5	4.5	22.0	13.0	14.1	9.5	34.0	6.0
31	14.0	1.0	15.0	13.0	12.8	6.0	30.0	4.0
32	13.0		13.0	13.0	9.9	5.0	19.0	3.0
33	17.5	4.5	22.0	13.0	12.2	6.9	26.0	4.0
34	17.5	4.5	22.0	13.0	12.6	6.2	29.0	6.0
36	28.0		28.0	28.0	16.5	10.0	31.0	3.0
37	22.3	11.0	32.0	7.0	20.6	8.0	31.0	9.0
38	17.5	10.5	28.0	7.0	22.3	13.3	48.0	11.0
39	28.0		28.0	28.0	15.6	7.9	33.0	3.0
41	40.0		40.0	40.0	17.4	8.4	30.0	10.0
42	36.0		36.0	36.0	21.1	9.8	41.0	8.0

Table 3 (continued). Point-based estimates of fire frequency for 57 sites within the Quartzite area.

		1886 - 1920				1671 - 1885		
Point	**MFFI**	**SD**	**Max FI**	**Min FI**	**MFFI**	**SD**	**Max FI**	**Min FI**
43	24.5	1.5	26.0	23.0	21.8	8.0	29.0	13.0
44					10.8	6.2	23.0	4.0
45	10.0		10.0	10.0	10.7	5.8	29.0	3.0
46					10.4	4.8	18.0	4.0
47					14.7	7.9	38.0	6.0
48	40.0		40.0	40.0	13.0	3.5	19.0	10.0
49	14.0	0.0	14.0	14.0	10.7	4.4	17.0	5.0
50	14.0	0.0	14.0	14.0	14.3	4.0	25.0	8.0
51	22.0		22.0	22.0	17.4	9.7	34.0	9.0
52					12.3	5.0	23.0	4.0
53					16.5	8.8	33.0	7.0
54	28.0		28.0	28.0	18.5	9.4	40.0	9.0
55	23.0		23.0	23.0	18.7	7.7	29.0	7.0
56					17.5	9.2	39.0	7.0
57	17.3	7.8	26.0	7.0	13.7	1.2	15.0	13.0
58	28.0		28.0	28.0	17.7	7.4	31.0	10.0
59					16.1	11.7	47.0	5.0
61					14.6	9.4	35.0	3.0

Table 4. Fire date synchroneity (jaccard index) between polygons within the Quartzite planning area (1671-1882).

Polygons	% Similarity	Polygons	% Similarity
1-2	23	3-5	31
1-3	27	3-6	22
1-4	23	3-7	18
1-5	19	3-8	29
1-6	33	4-5	49*
1-7	28	4-6	28
1-8	16	4-7	18
2-3	59	4-8	34
2-4	49	5-6	31*
2-5	33	5-7	26
2-6	16	5-8	25
2-7	12	6-7	49*
2-8	26	6-8	19
3-4	41	7-8	15

* Adjacent polygons

Table 5. Mean age and diameter (inches) at initial fire scar for quartzite planning area.

		Age			Diameter		
Polygon	# Samples	Mean	Std dev	Range	Mean	Std dev	Range
1	7	29.0	27.0	5.0-84.0	4.9	4.9	1.0-13.8
2	7	22.7	15.8	5.0-48.0	3.6	2.0	0.7-7.0
3	5	21.6	10.0	11.0-36.0	3.7	1.7	2.0-6.0
4	3	33.0	33.9	11.0-72.0	2.4	1.8	1.1-4.4
5	9	26.2	11.3	11.0-48.0	3.9	2.1	1.4-7.0
6	8	46.0	25.6	16.0-90.0	8.2	7.6	2.2-25.0
7	3	60.3	49.7	24.0-117.0	7.9	5.6	4.6-14.4
8	0	-	-	-	-	-	-
All Polygons	42	32.2	24.5	5.0-117.0	5.0	4.5	0.7-25.0

FIGURES

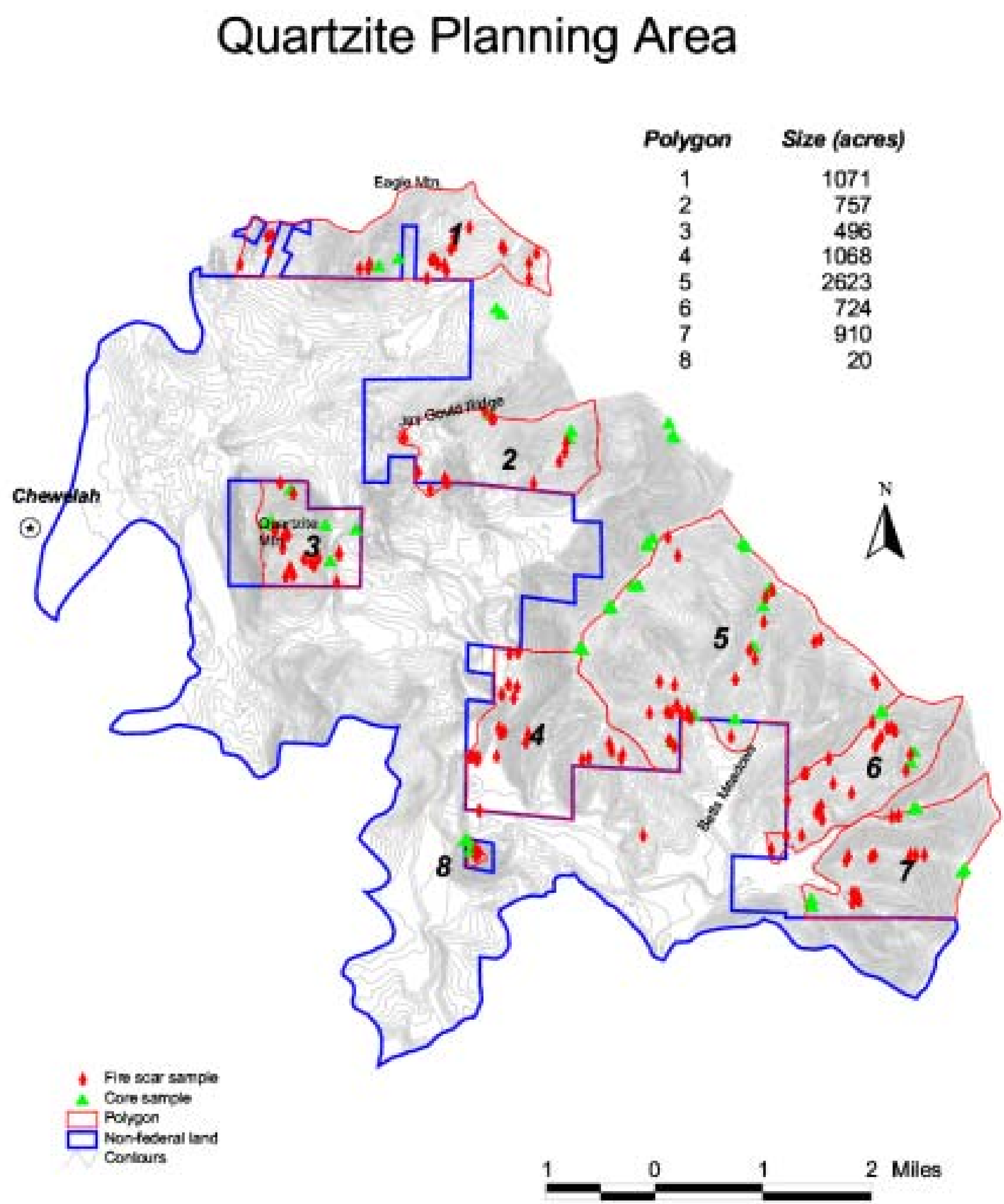


Figure 1. Quartzite planning area map showing polygon, fire-scar, and tree-core locations along with size of each polygon.

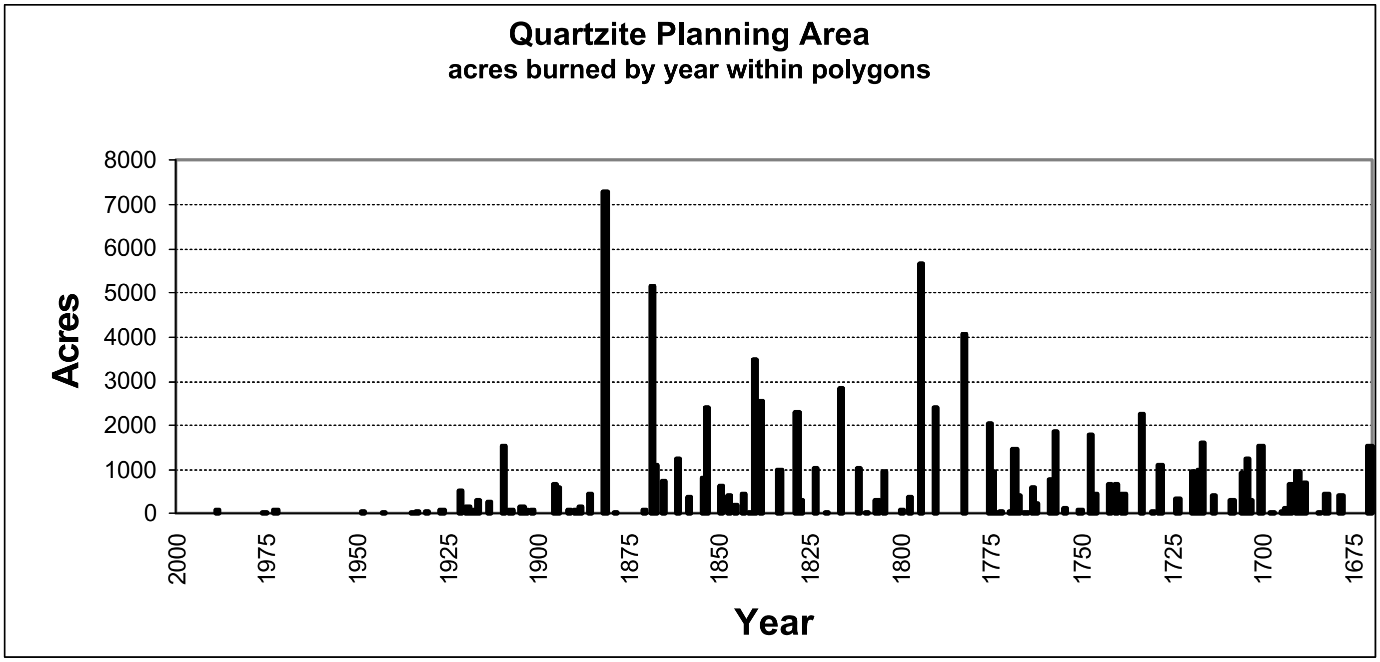


Figure 2. Graph showing the estimated acreage burned within the sampled portion of the Quartzite planning area by year.

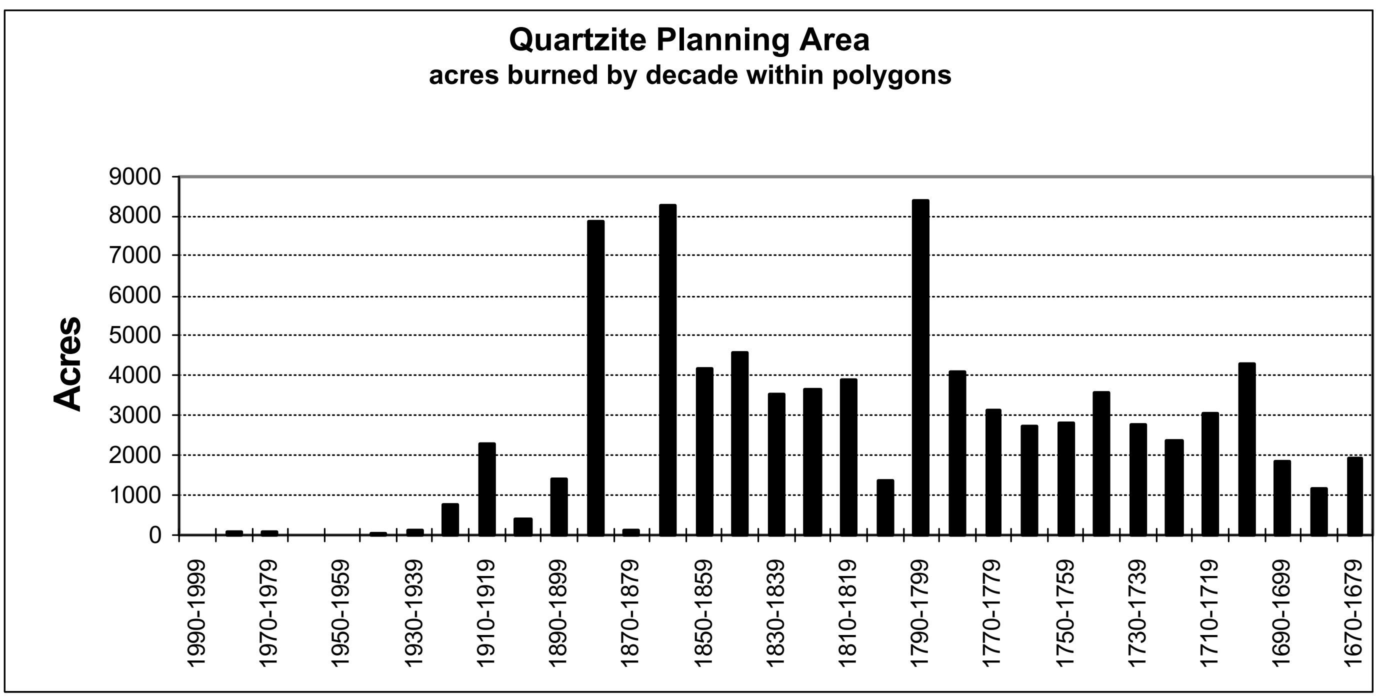


Figure 3. Graph showing the estimated acreage burned within the sampled portion of the Quartzite planning area by decade.

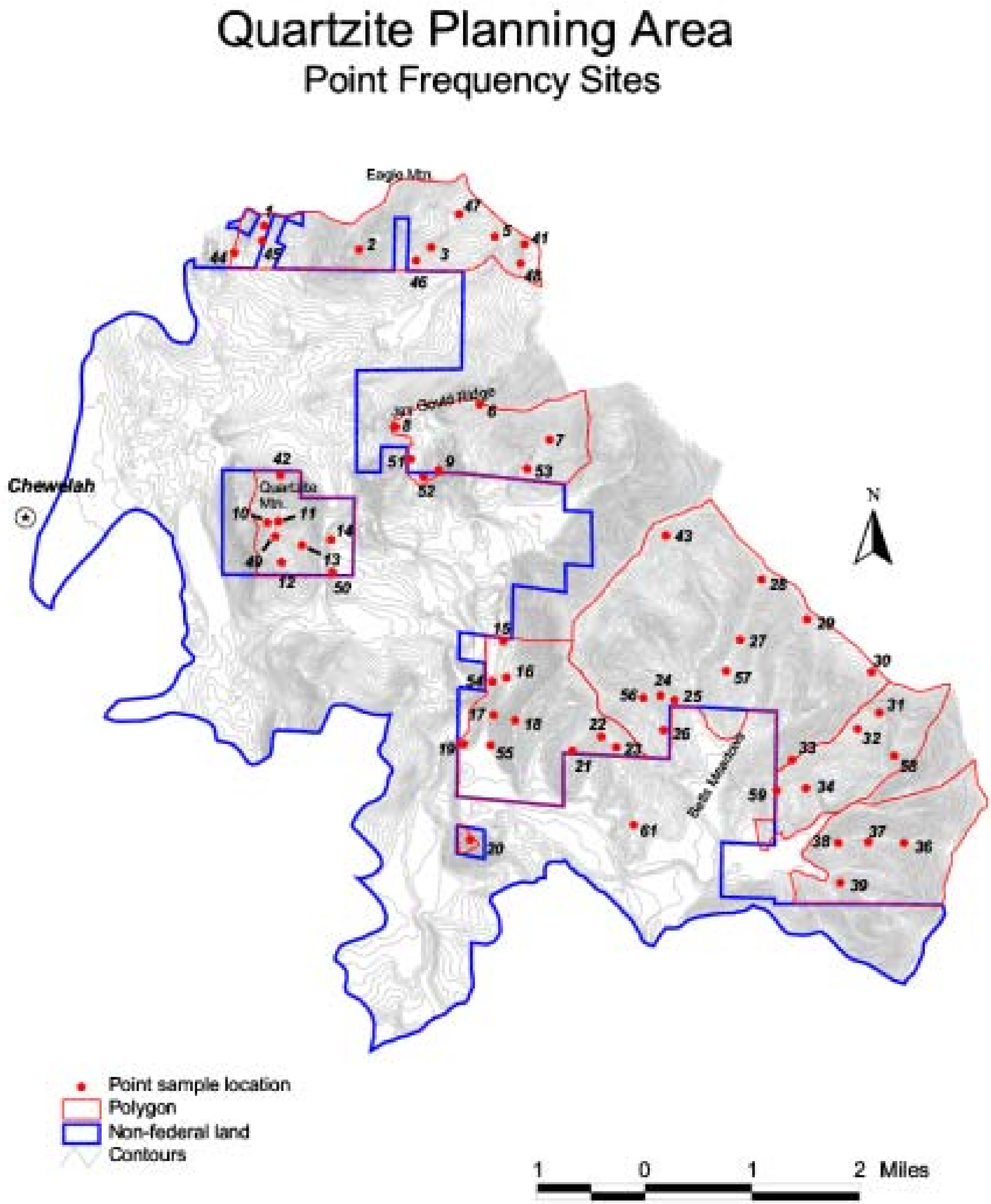
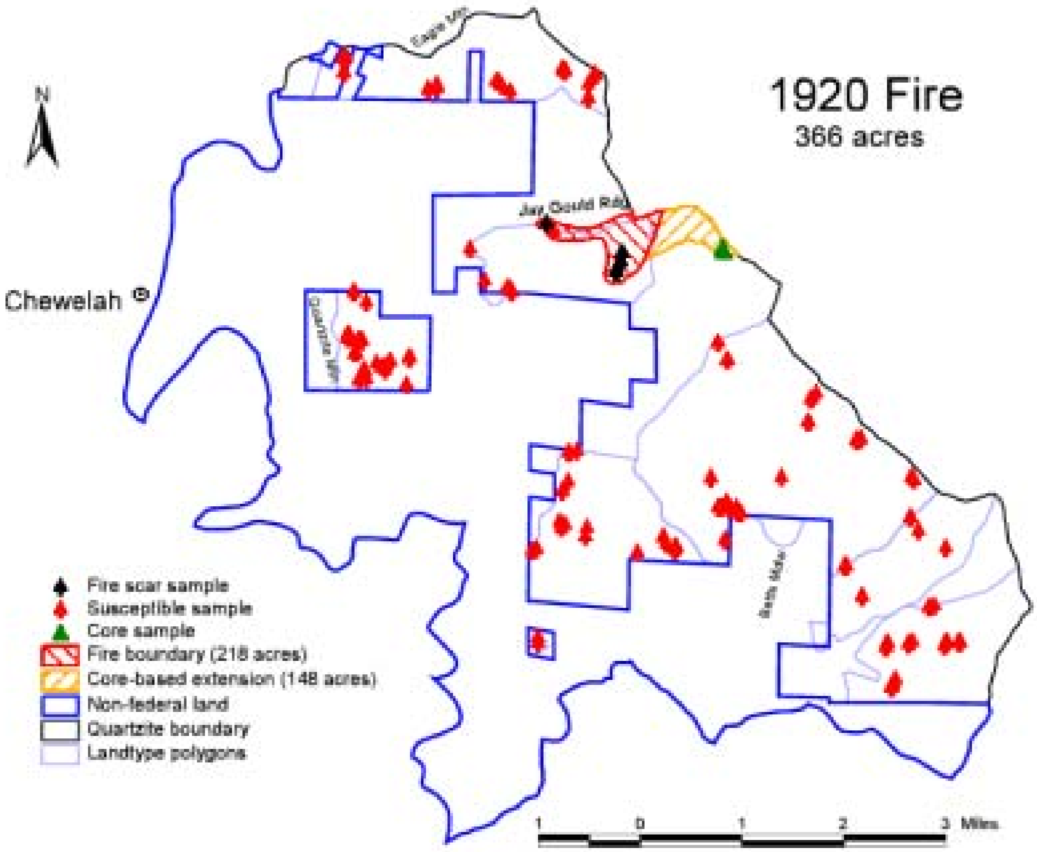
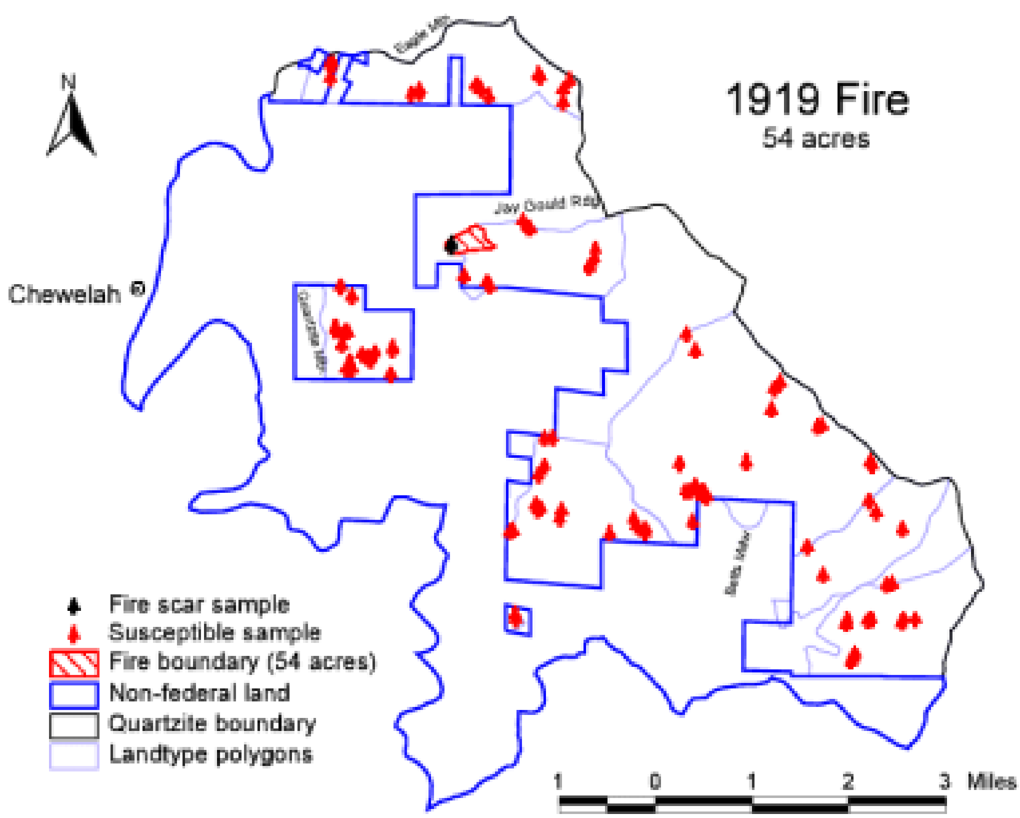


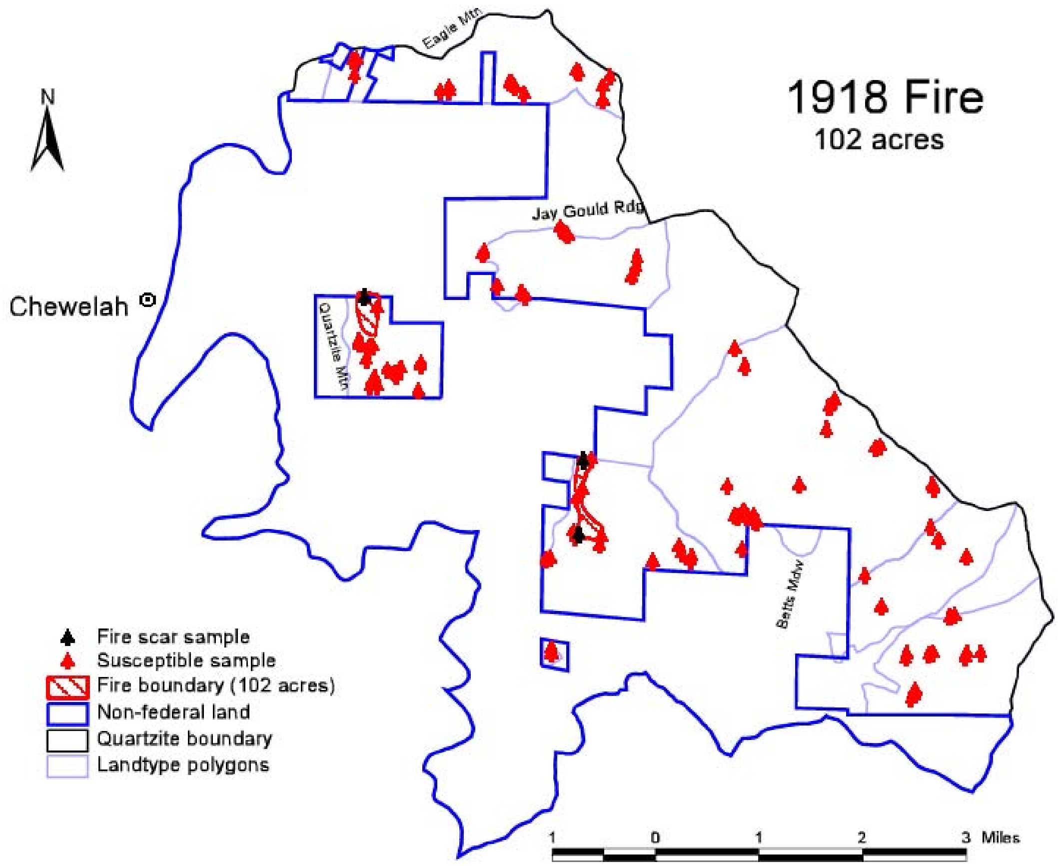
Figure 4. Map showing the locations of point-based fire return intervals.

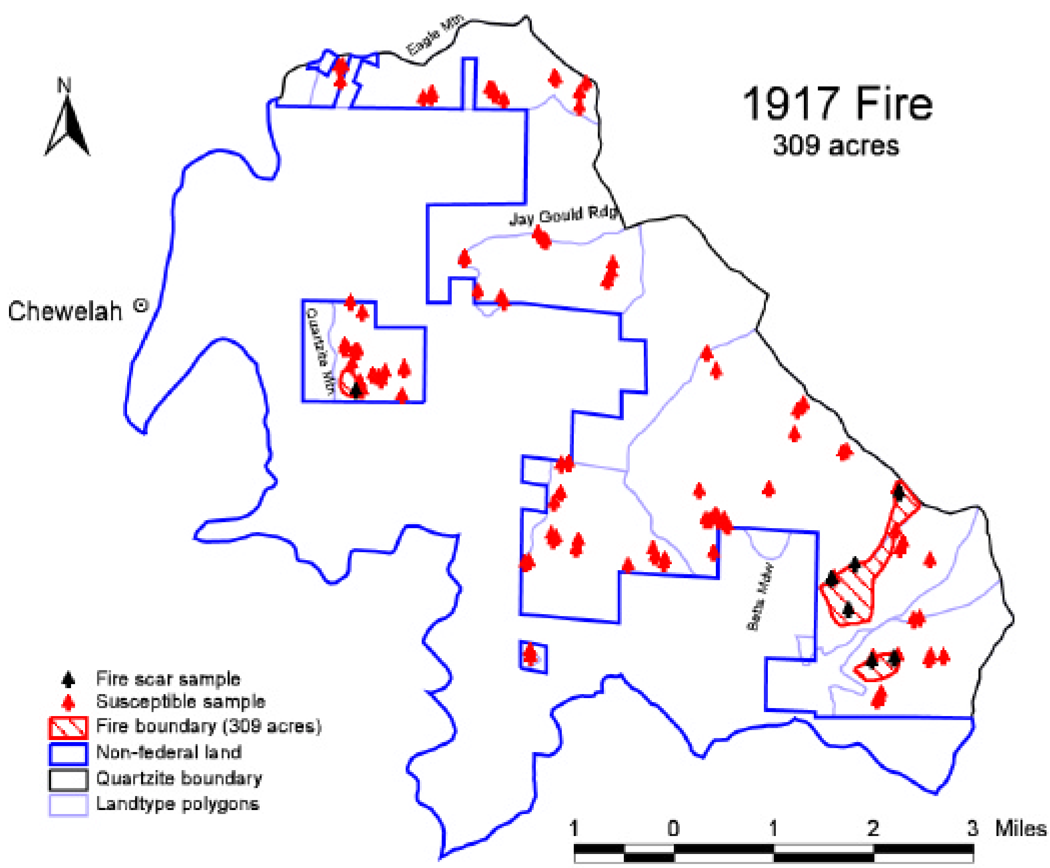
APPENDIX

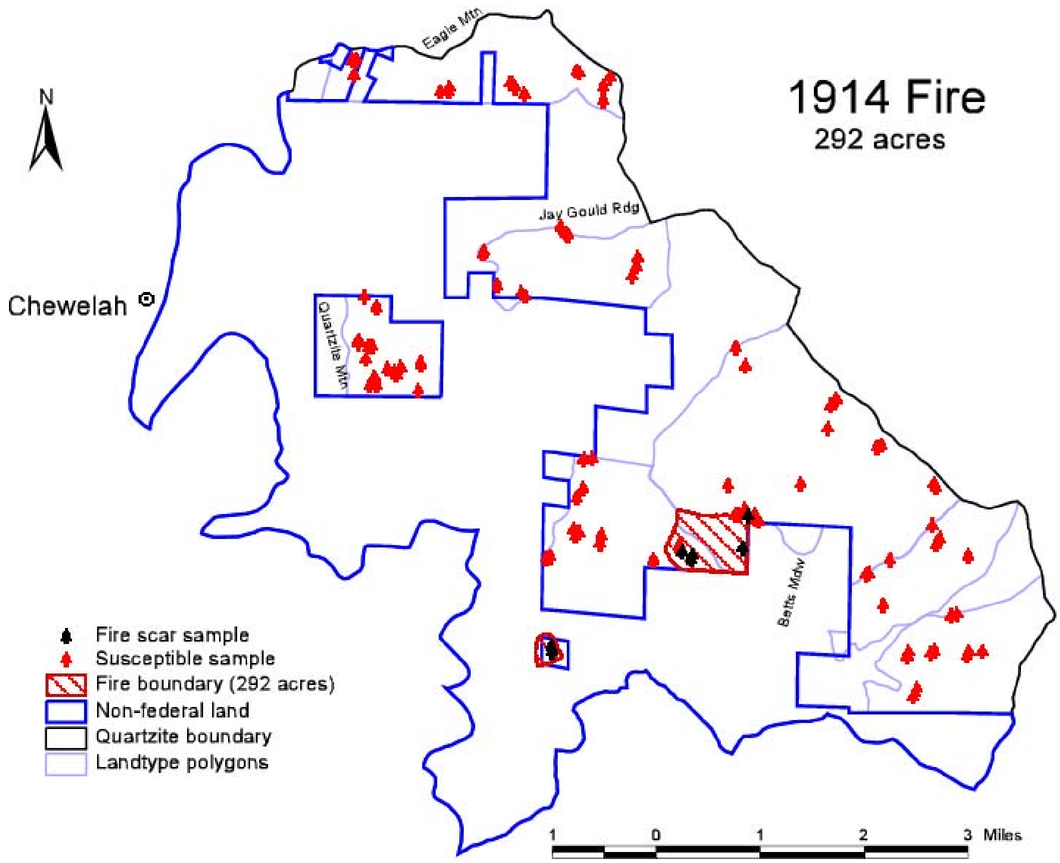
The following maps show fire extent based on the more conservative method described in the report (in red) as well as a less conservative method (additional area added in yellow). Fire size, listed beneath the date, includes the area covered by both red and yellow. The black "trees" show locations of fire scarred material that provide evidence for each fire. The red "trees" are those that would have been susceptible to scarring, having already been scarred by a previous fire. Green triangles show locations of cohort-based data (derived form analyses of increment cores) from which the extended fire boundary was derived.

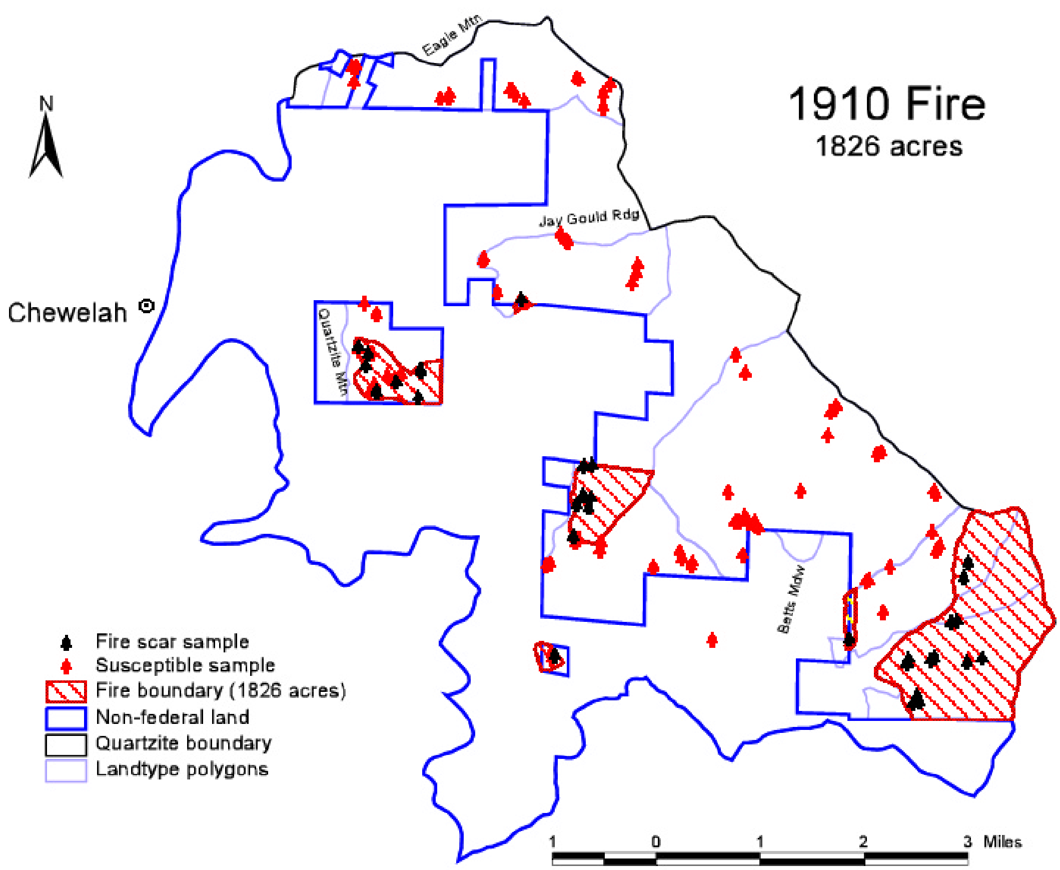

1920 Fire
366 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (218 acres)
Core-based extension (148 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

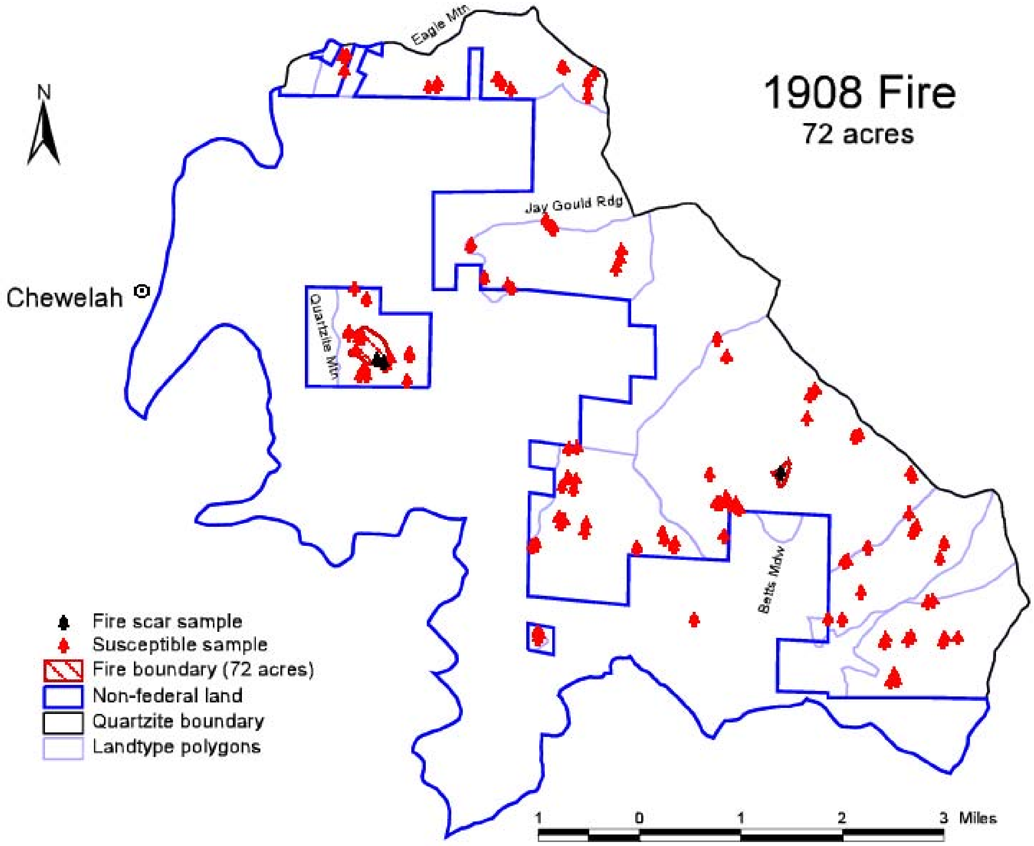

1919 Fire
54 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (54 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

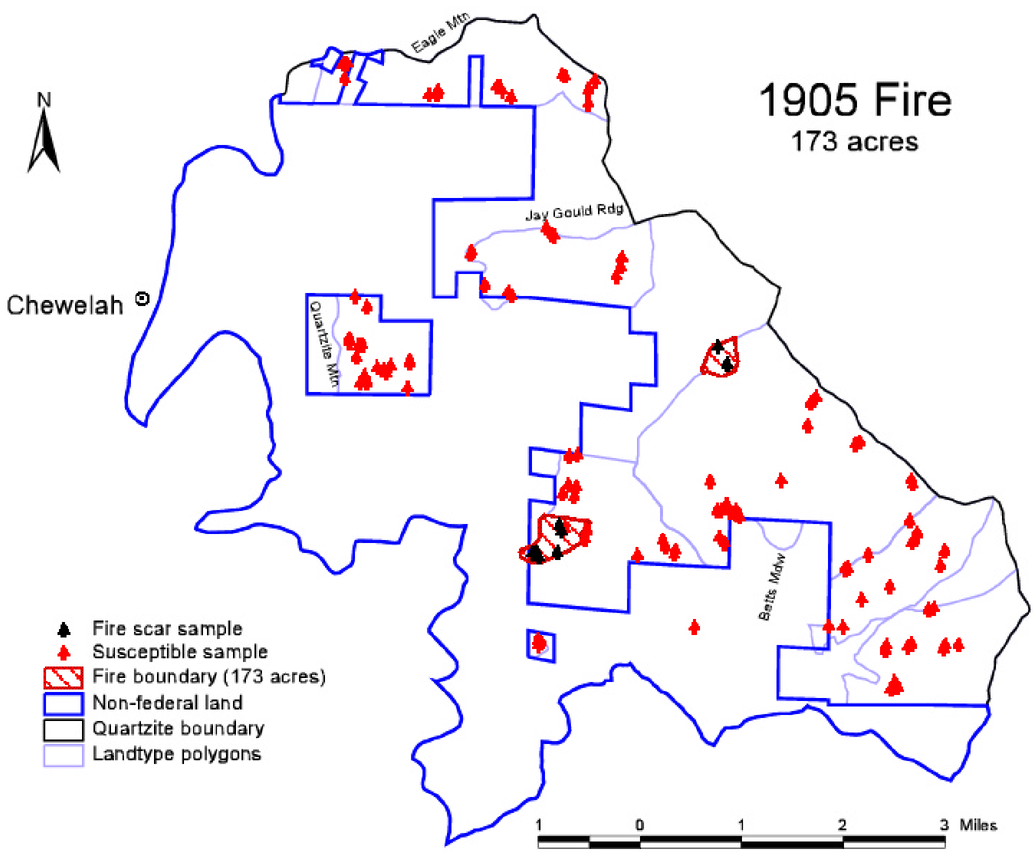

1918 Fire
102 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (102 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

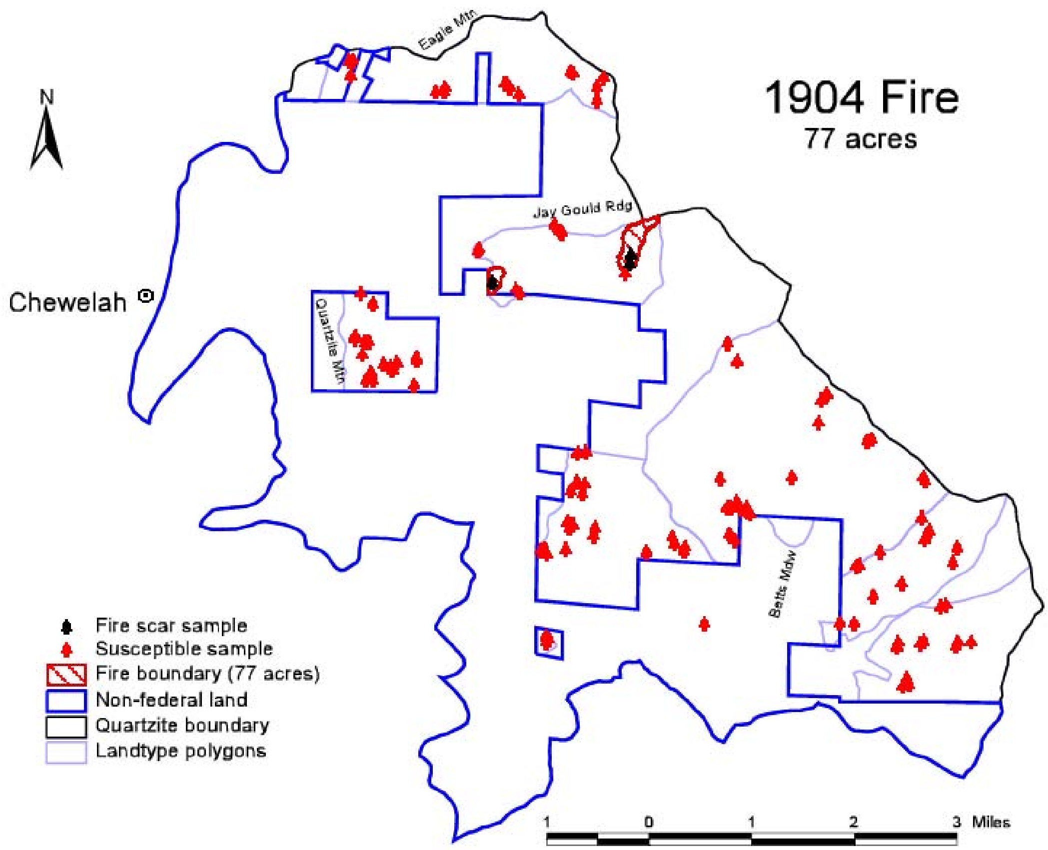

1917 Fire
309 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (309 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

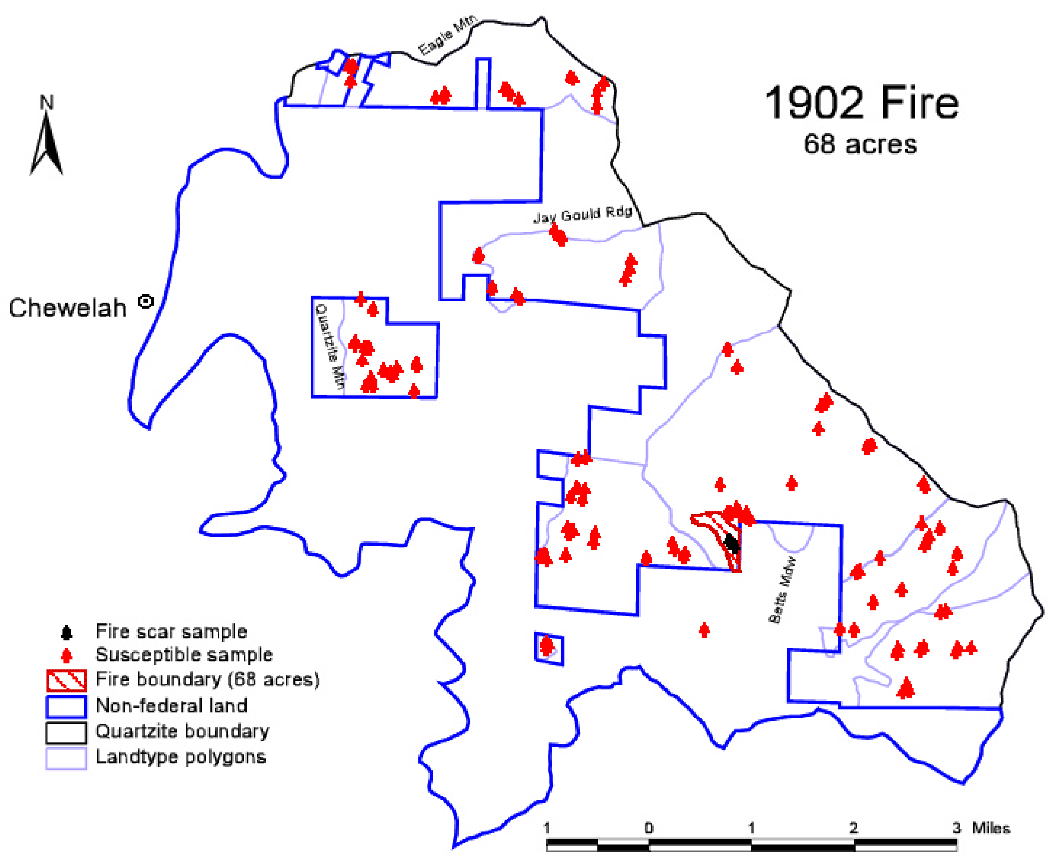

1914 Fire
292 acres
Eagle Mtn
N
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (292 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

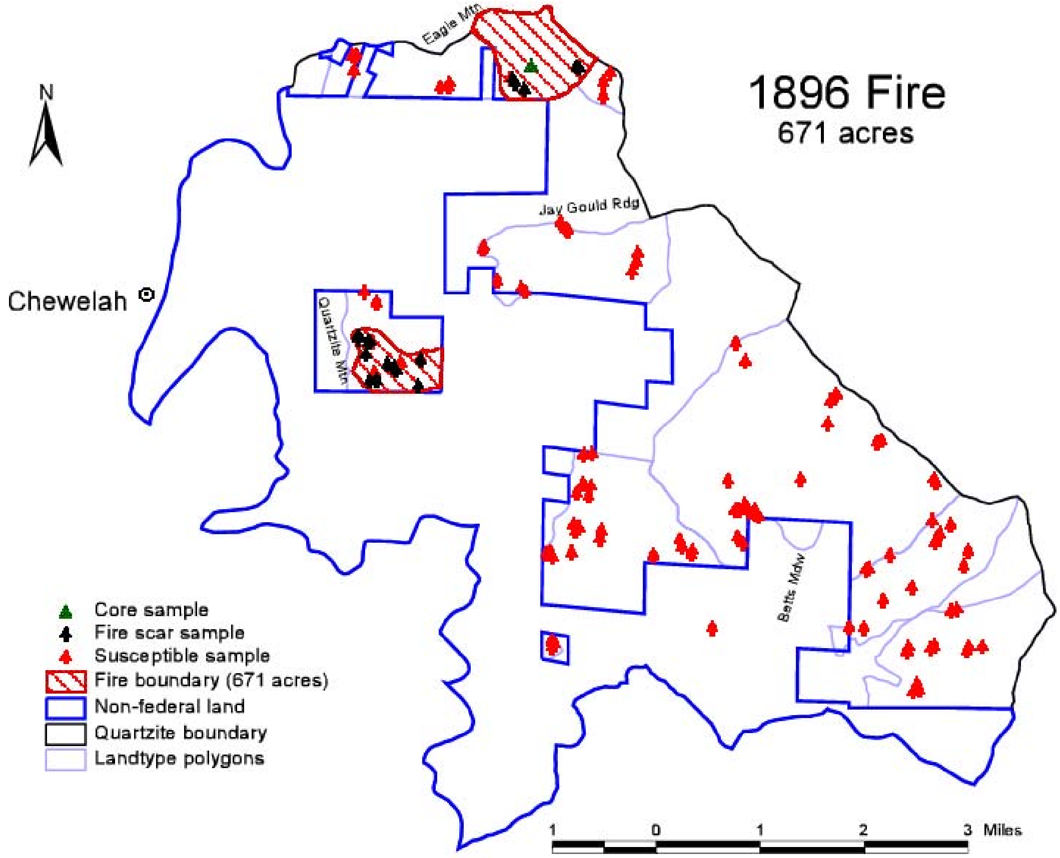

1910 Fire
1826 acres
Eagle Mtn
N
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (1826 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

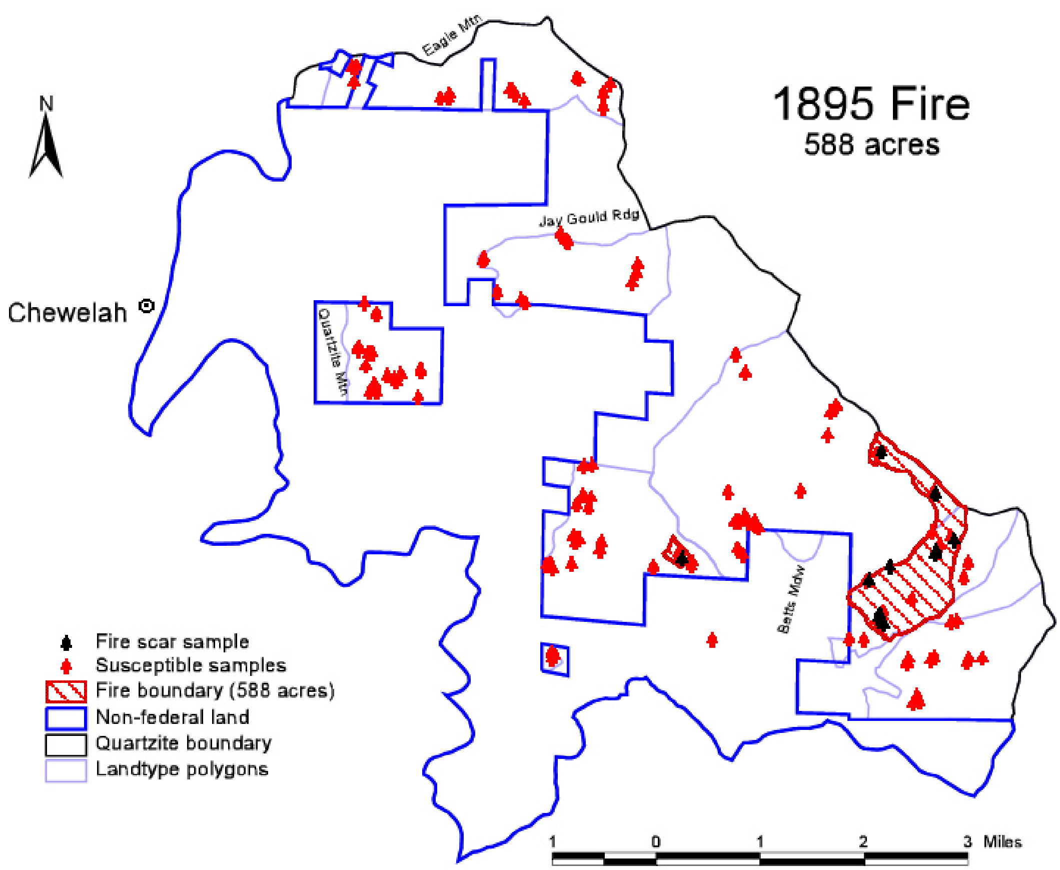

1908 Fire
72 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (72 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

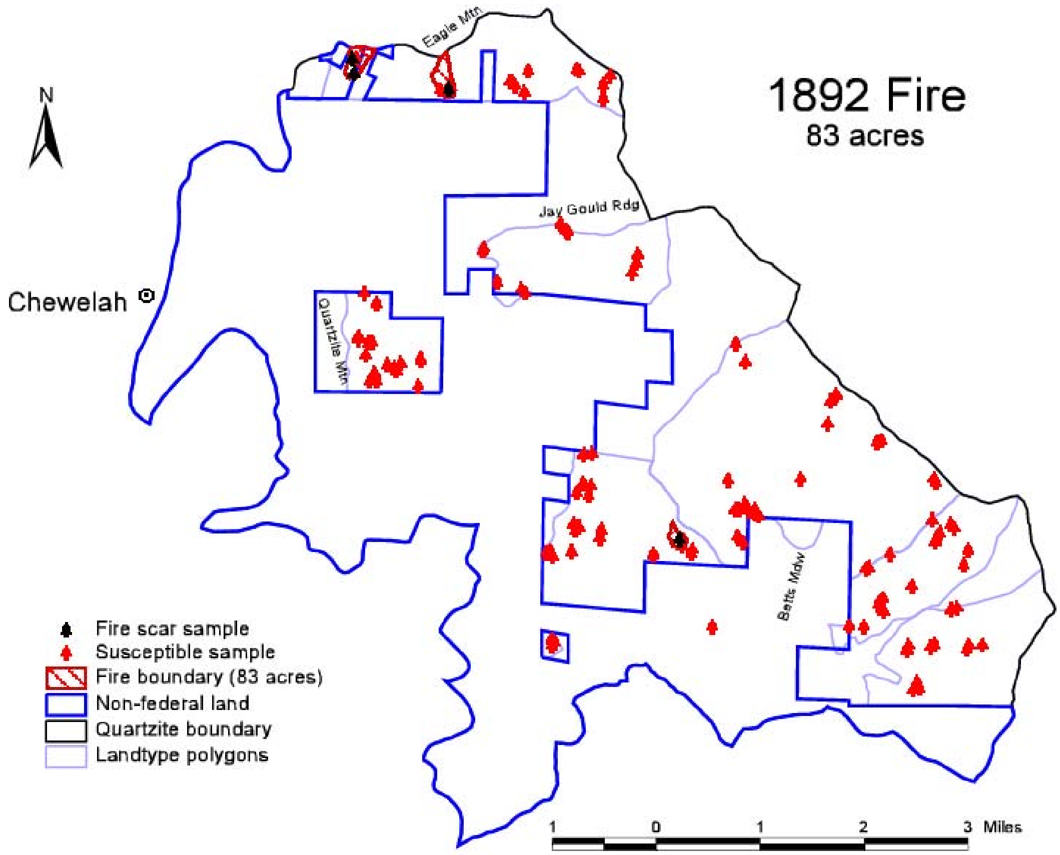

1905 Fire
173 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (173 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

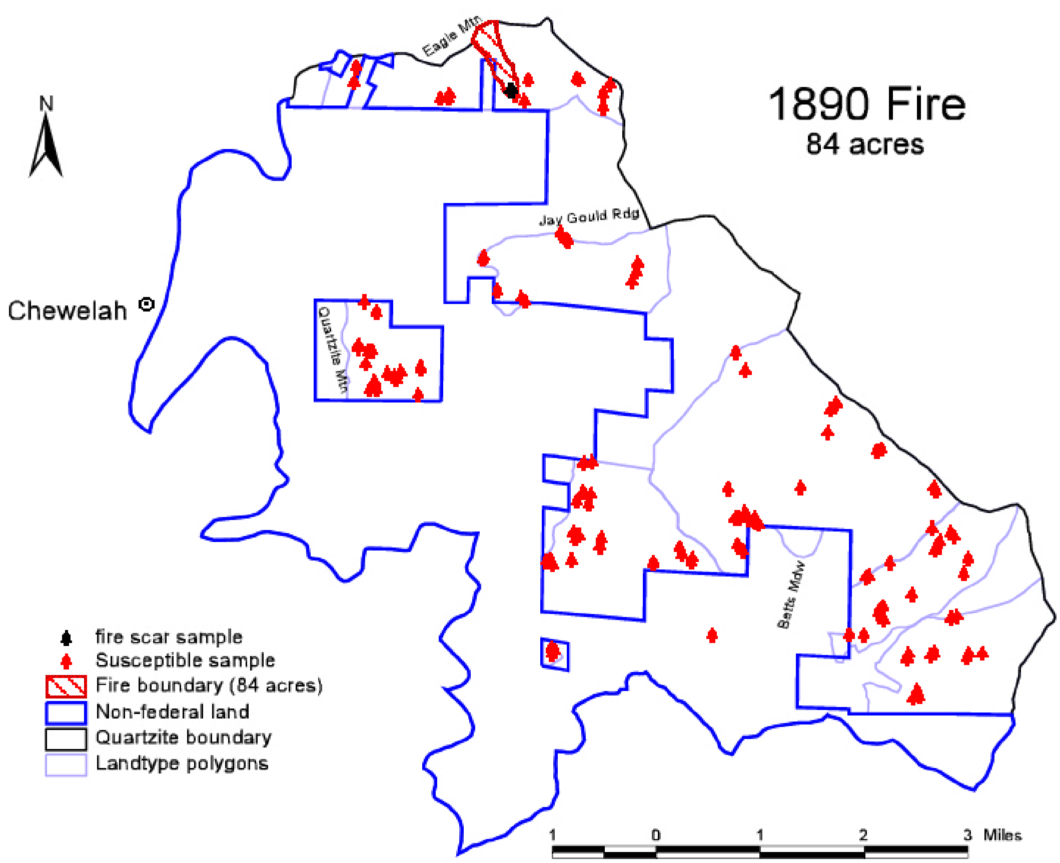

1904 Fire
77 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (77 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3
Miles

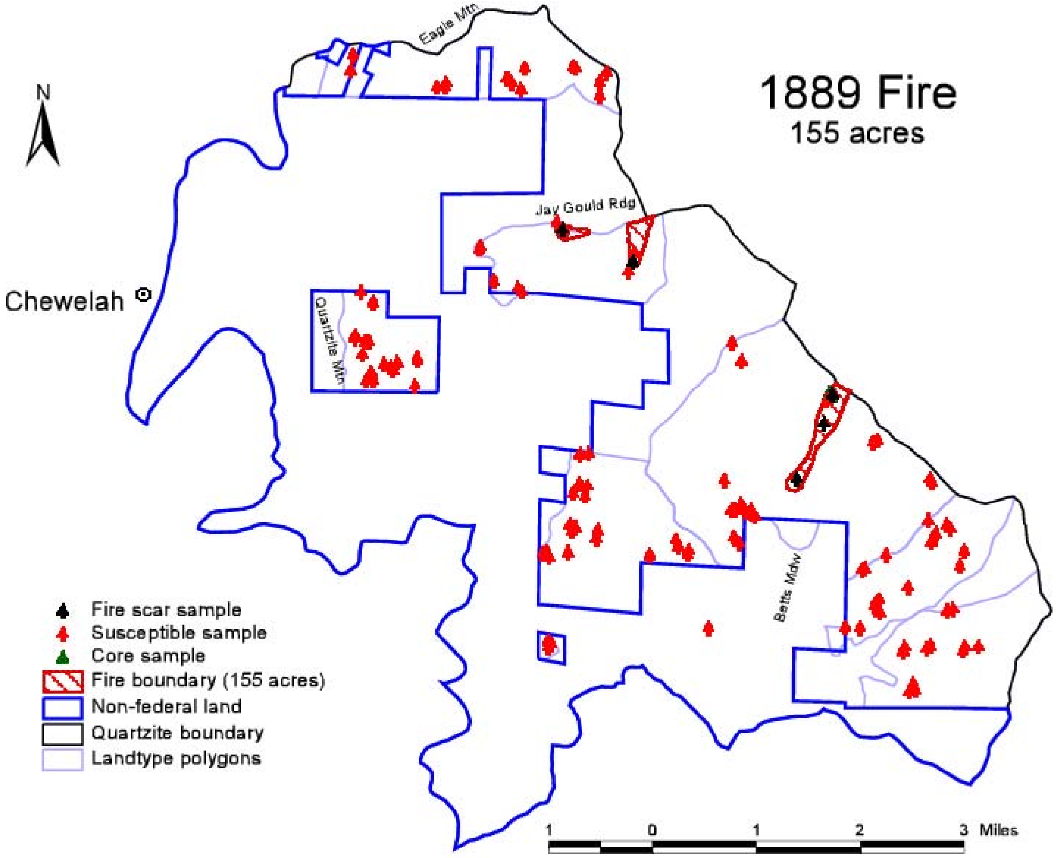

1902 Fire
68 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (68 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3
Miles

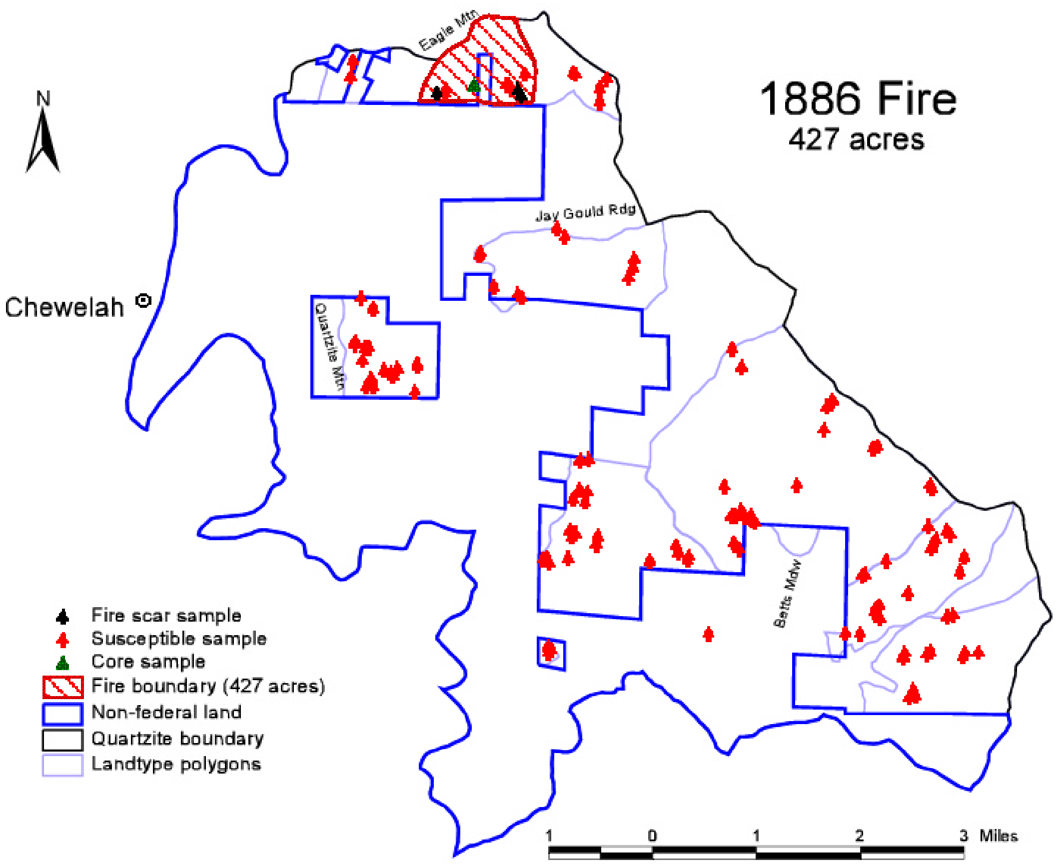

1896 Fire
671 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Core sample
Fire scar sample
Susceptible sample
Fire boundary (671 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

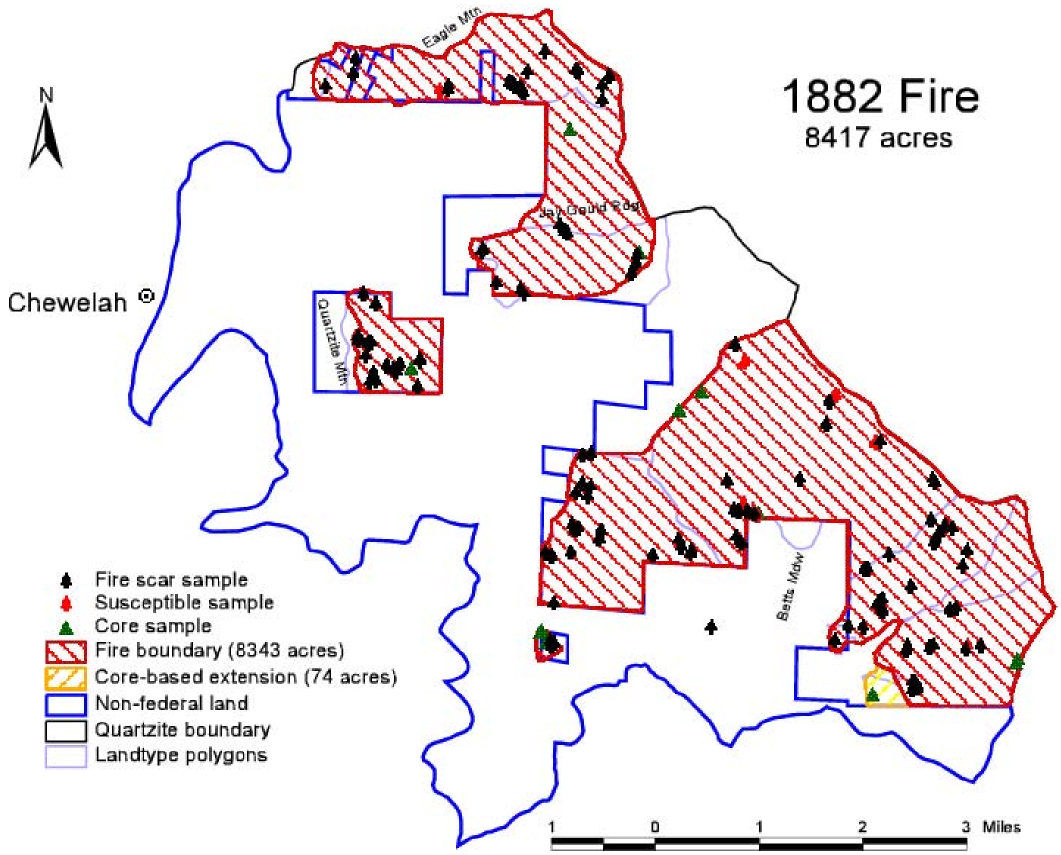

1895 Fire
588 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible samples
Fire boundary (588 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

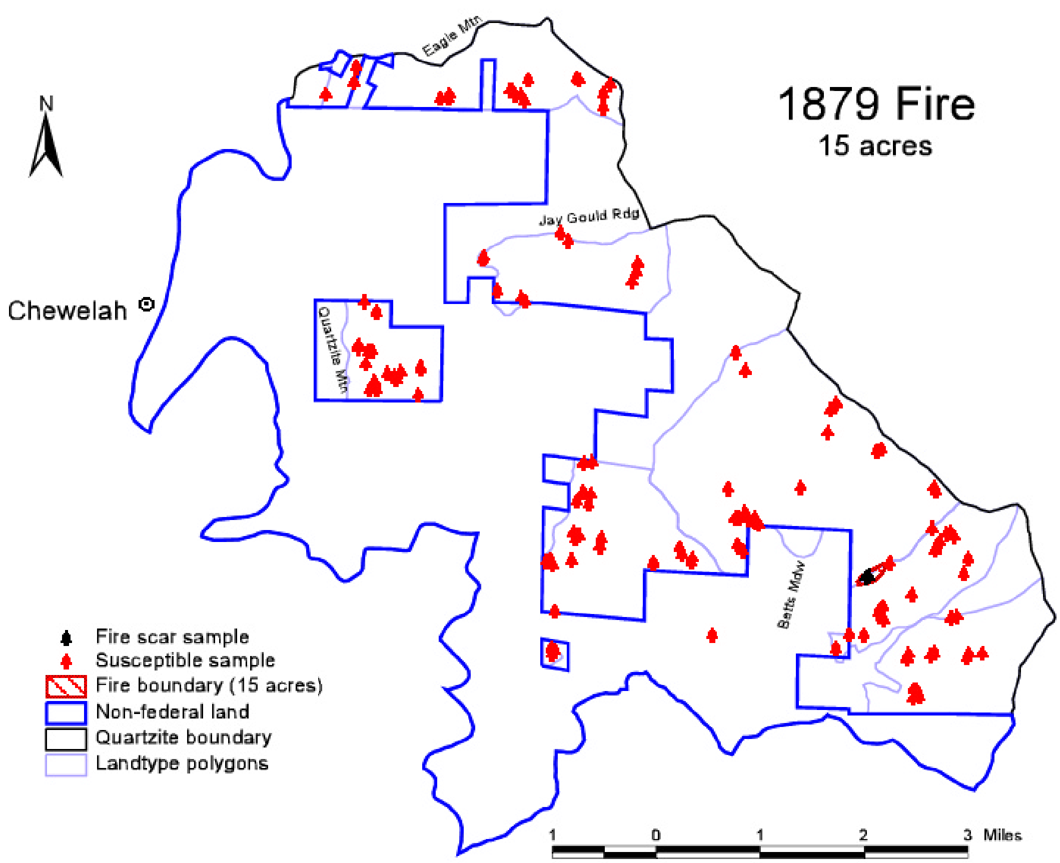

1892 Fire
83 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (83 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

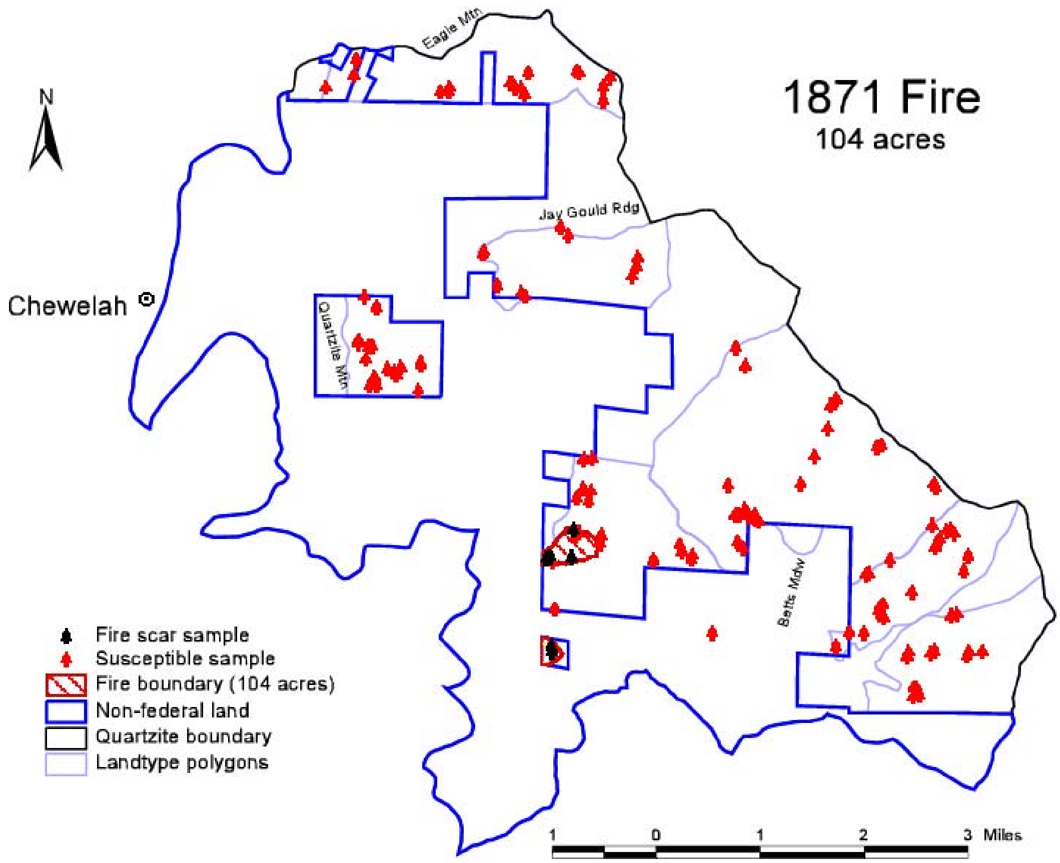

1890 Fire
84 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
fire scar sample
Susceptible sample
Fire boundary (84 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

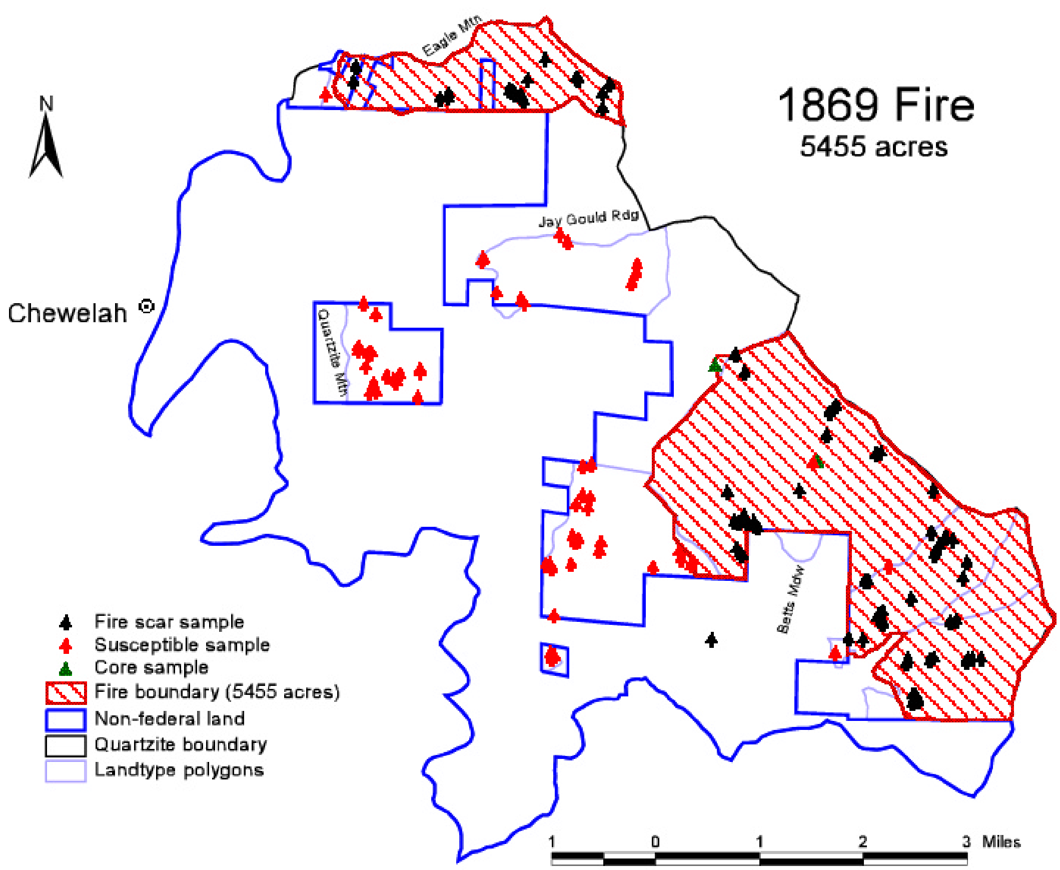

1889 Fire
155 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (155 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

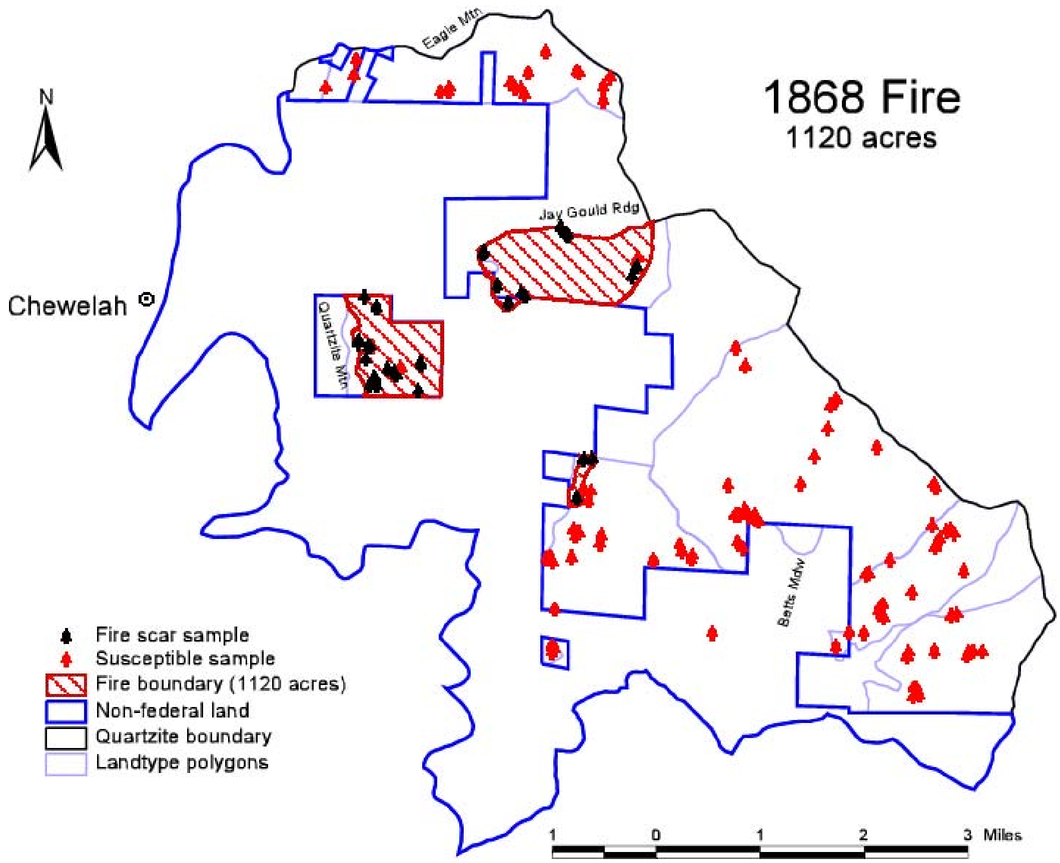

1886 Fire
427 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (427 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

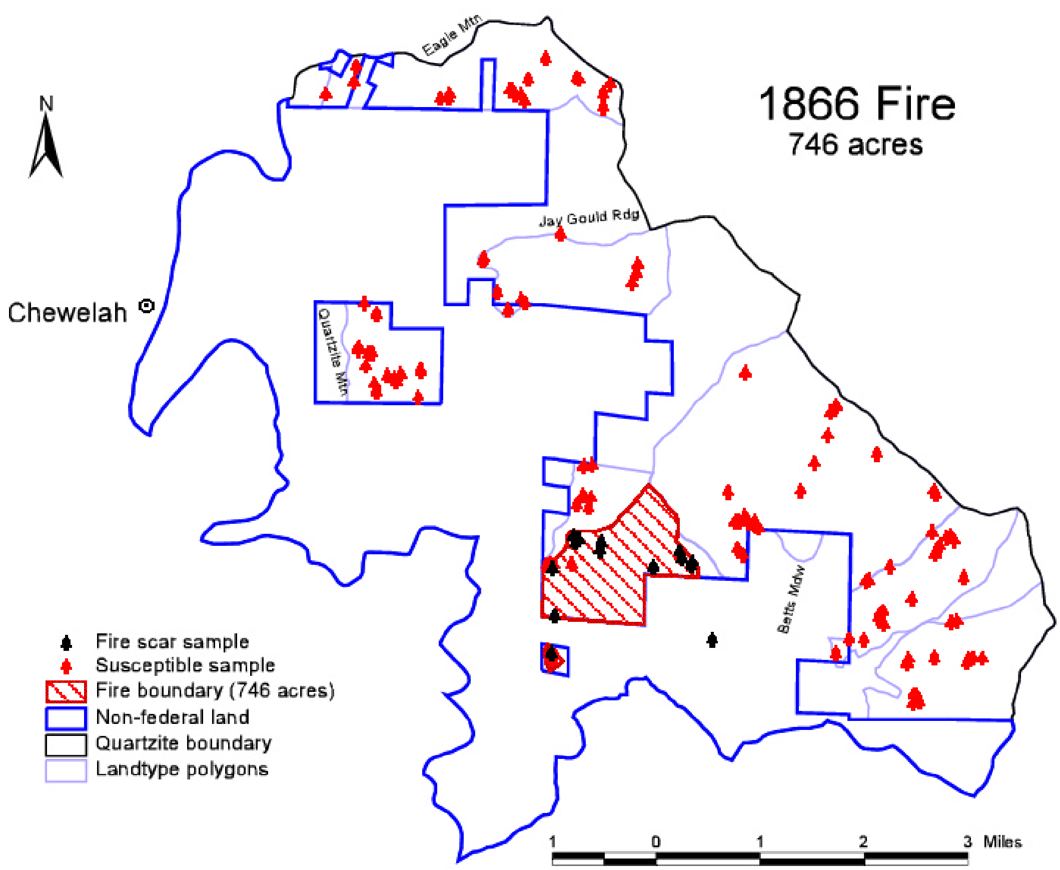

1882 Fire
8417 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (8343 acres)
Core-based extension (74 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

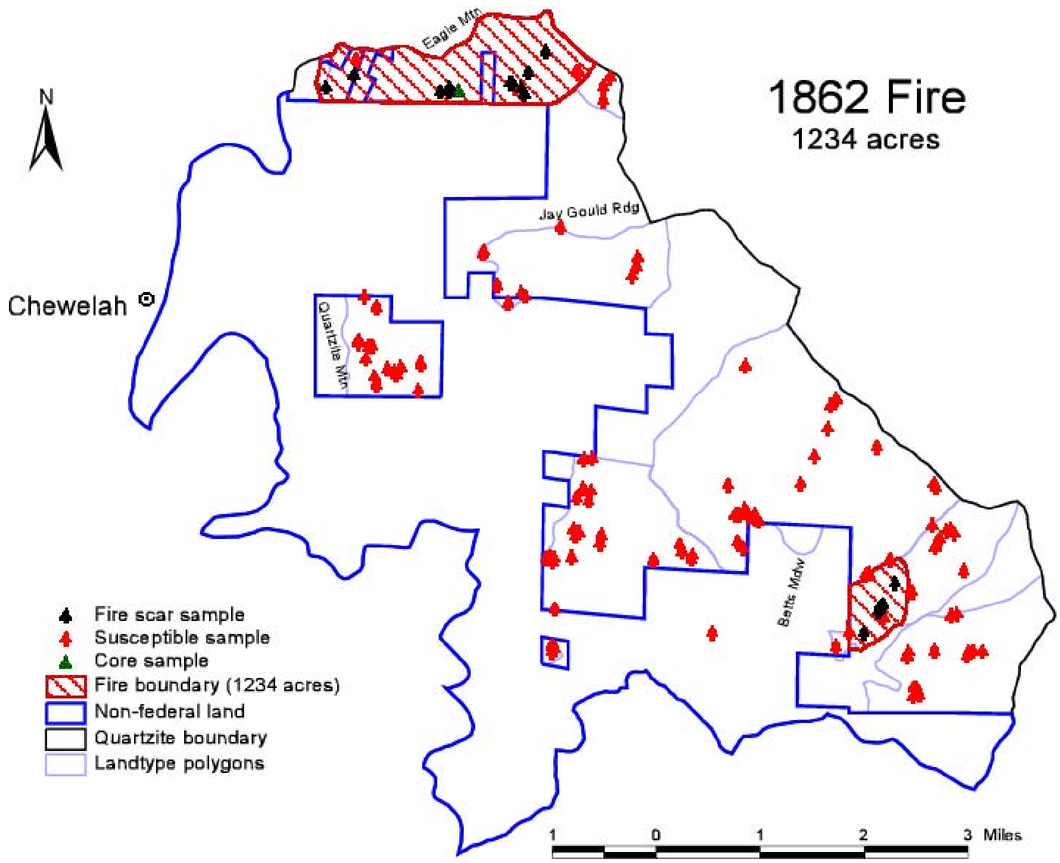

1879 Fire
15 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (15 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

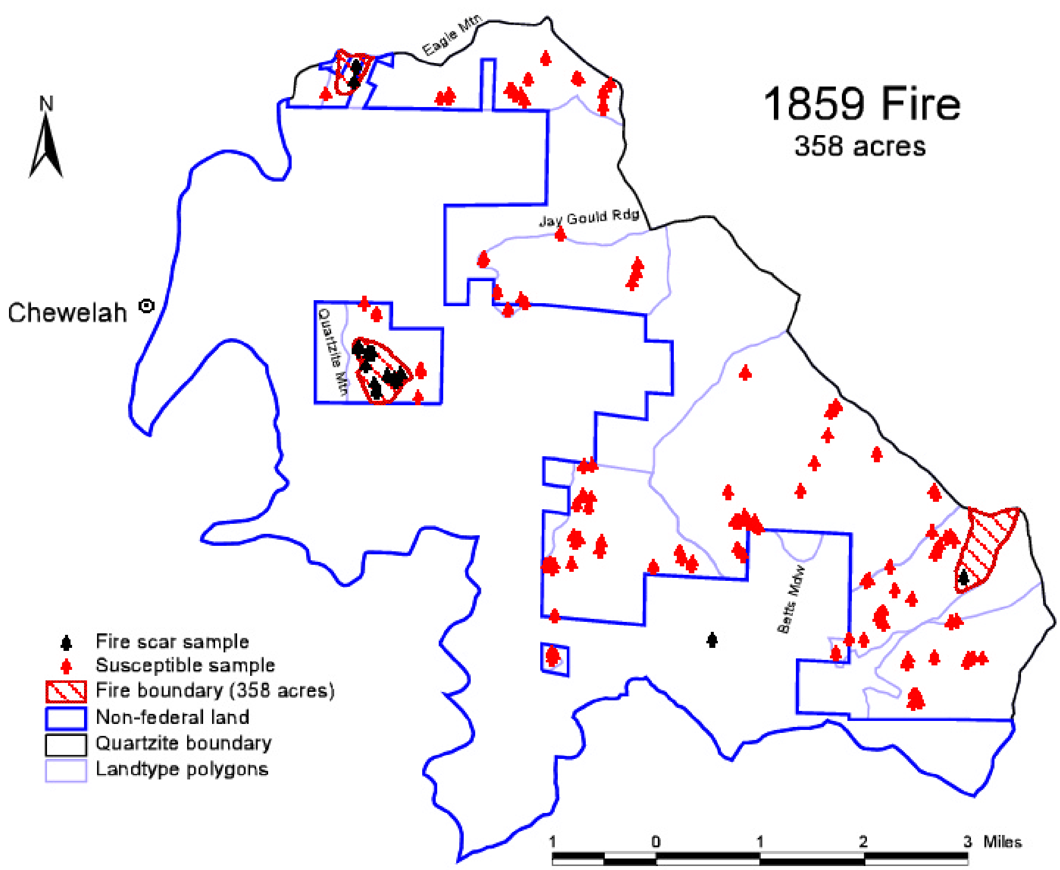

1871 Fire
104 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (104 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

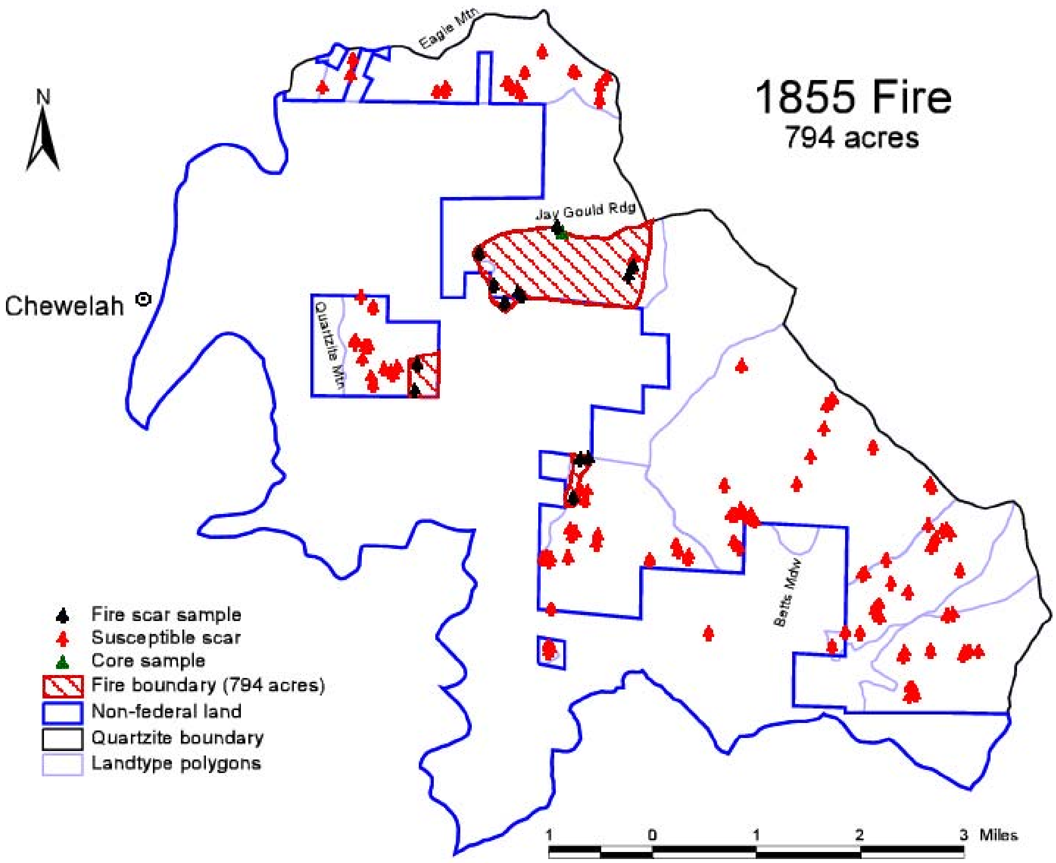

1869 Fire
5455 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (5455 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

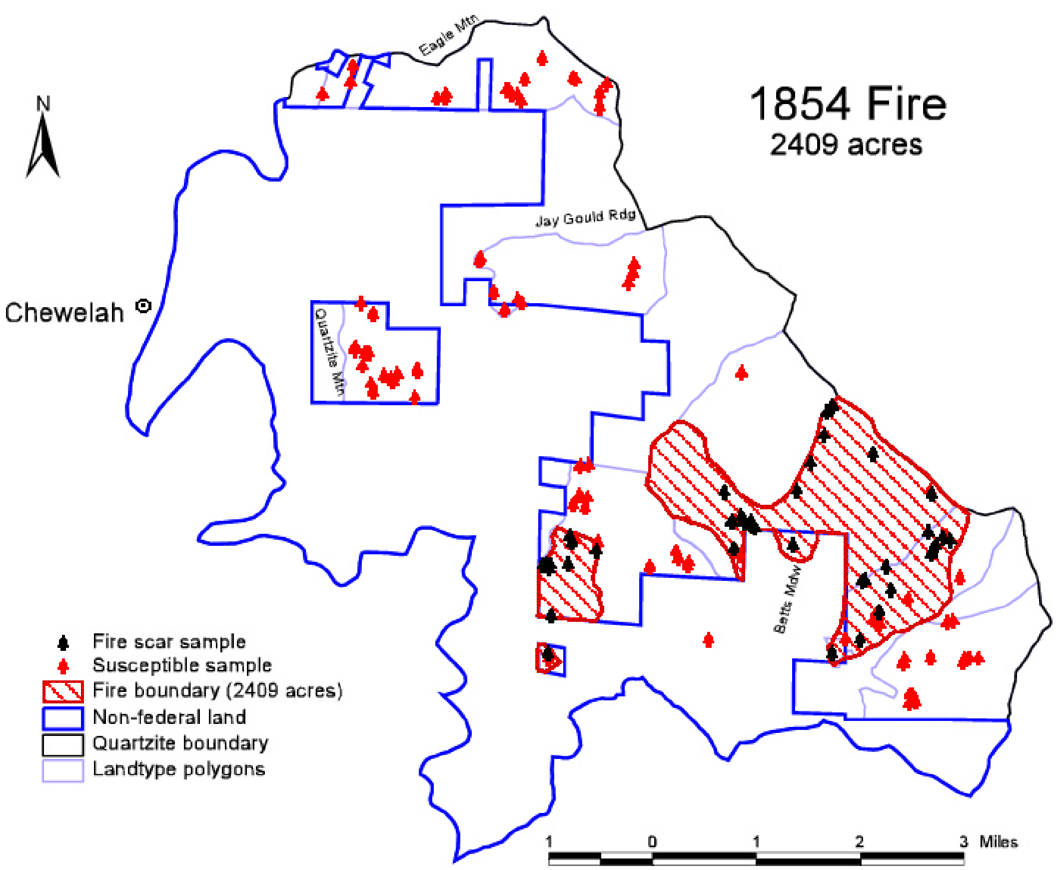

1868 Fire
1120 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (1120 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

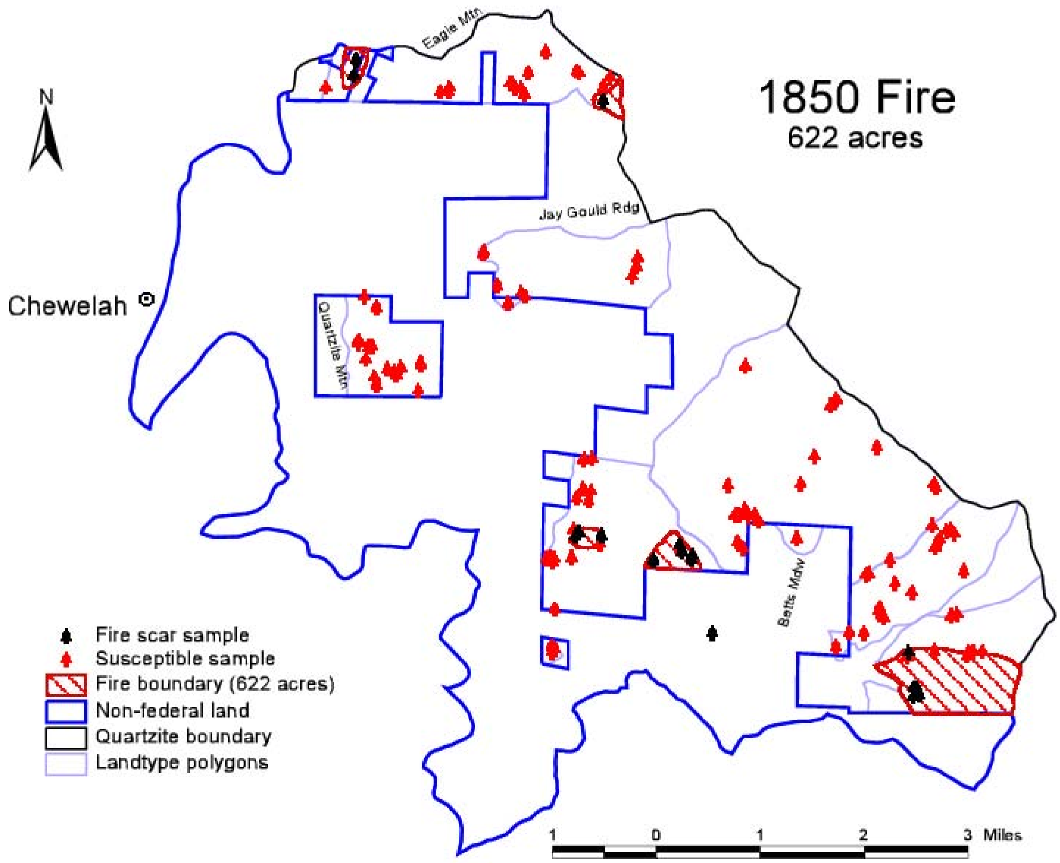

1866 Fire
746 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (746 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

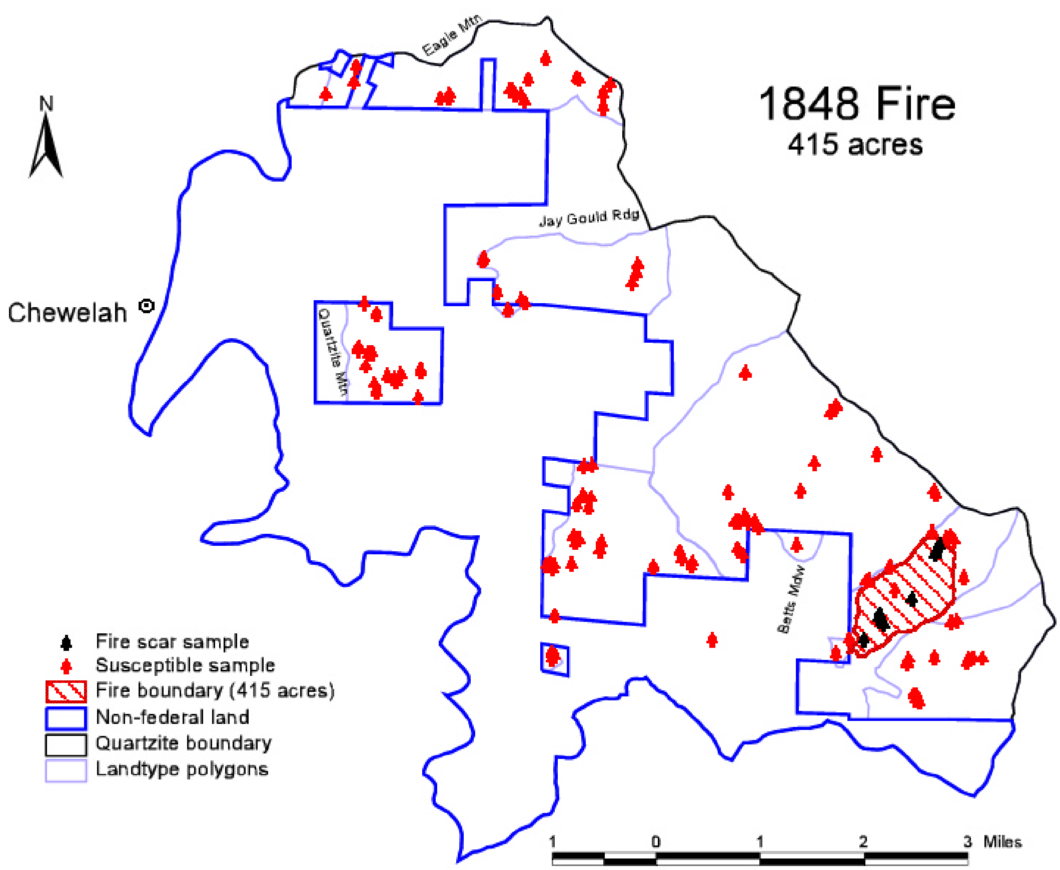

1862 Fire
1234 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1234 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

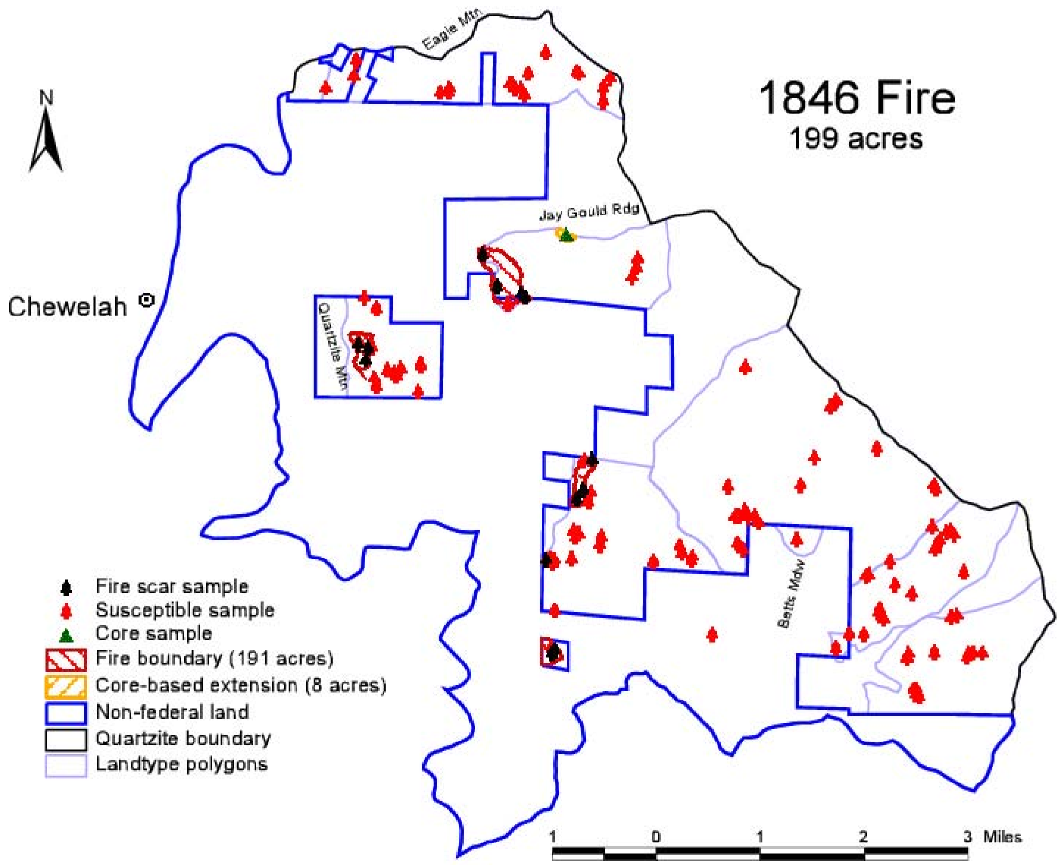

1859 Fire
358 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (358 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

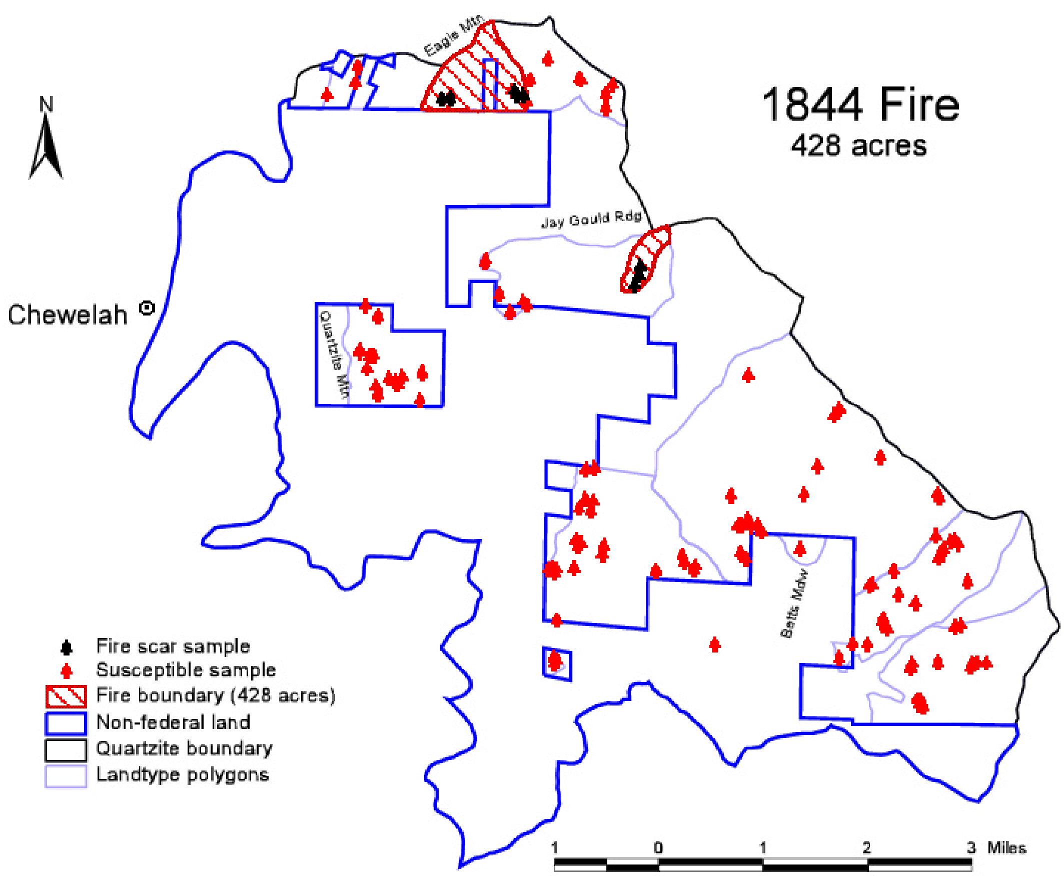

1855 Fire
794 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible scar
Core sample
Fire boundary (794 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

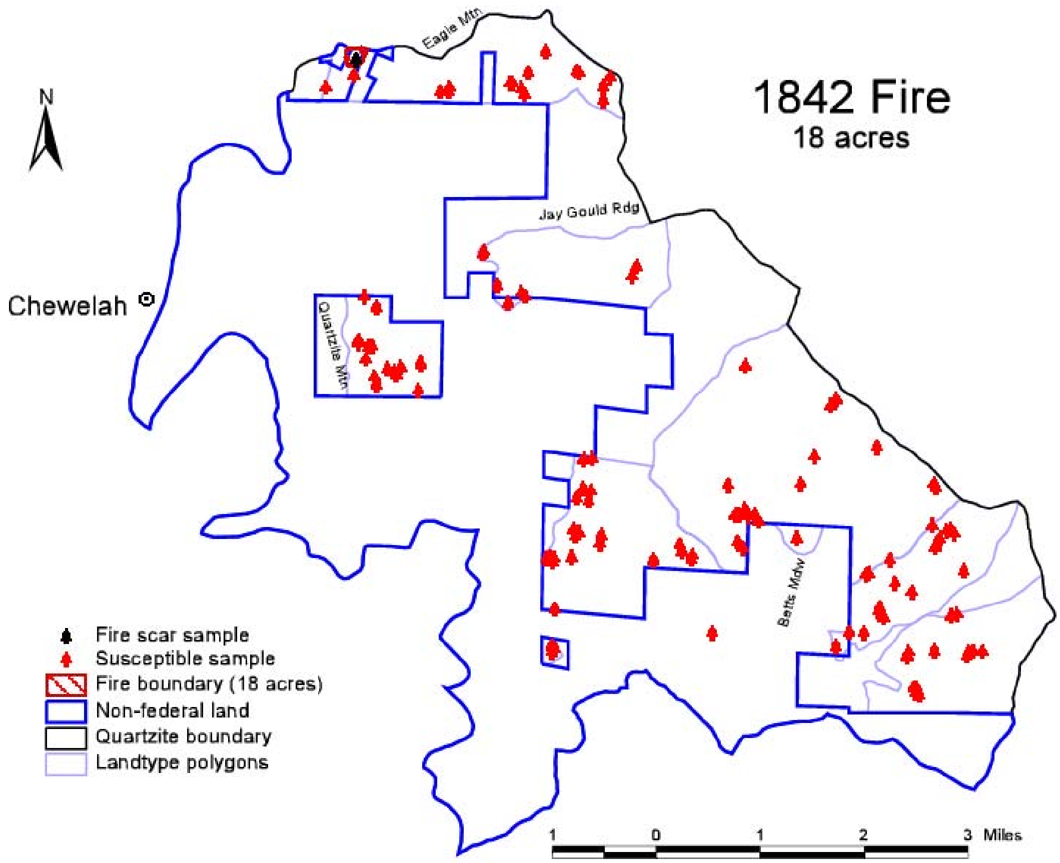

1854 Fire
2409 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (2409 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

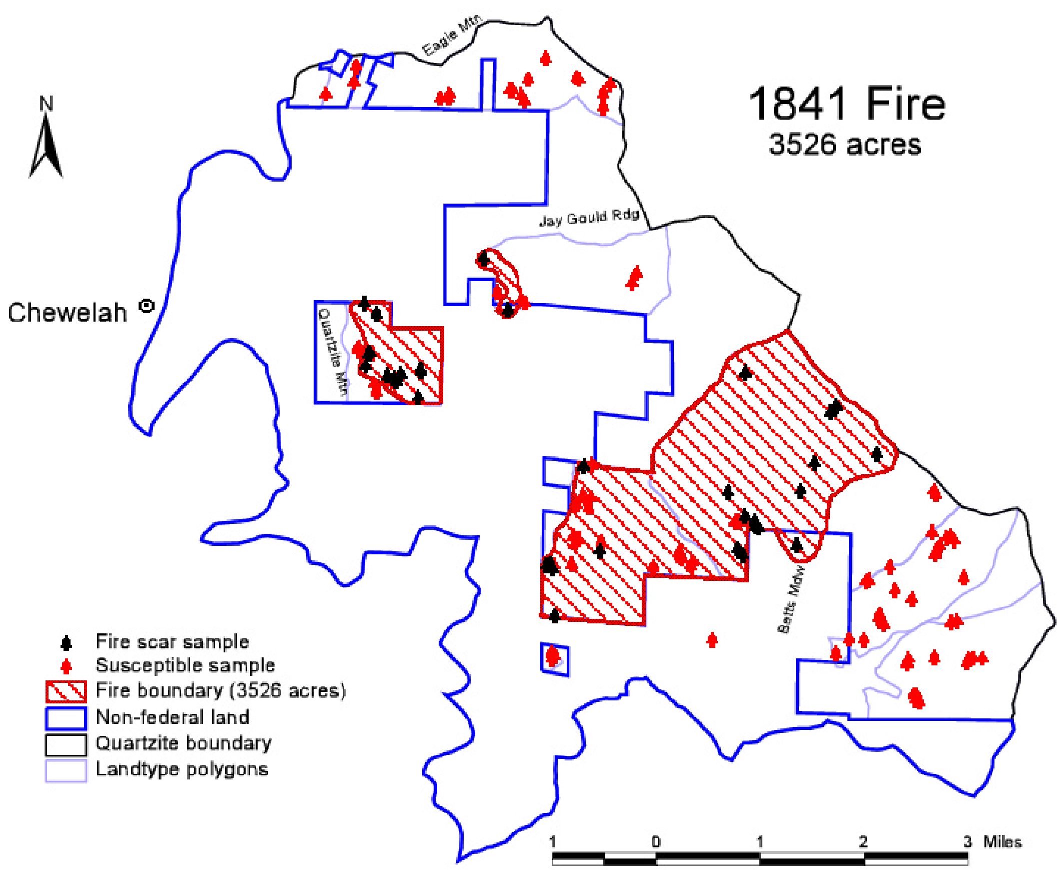

1850 Fire
622 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (622 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

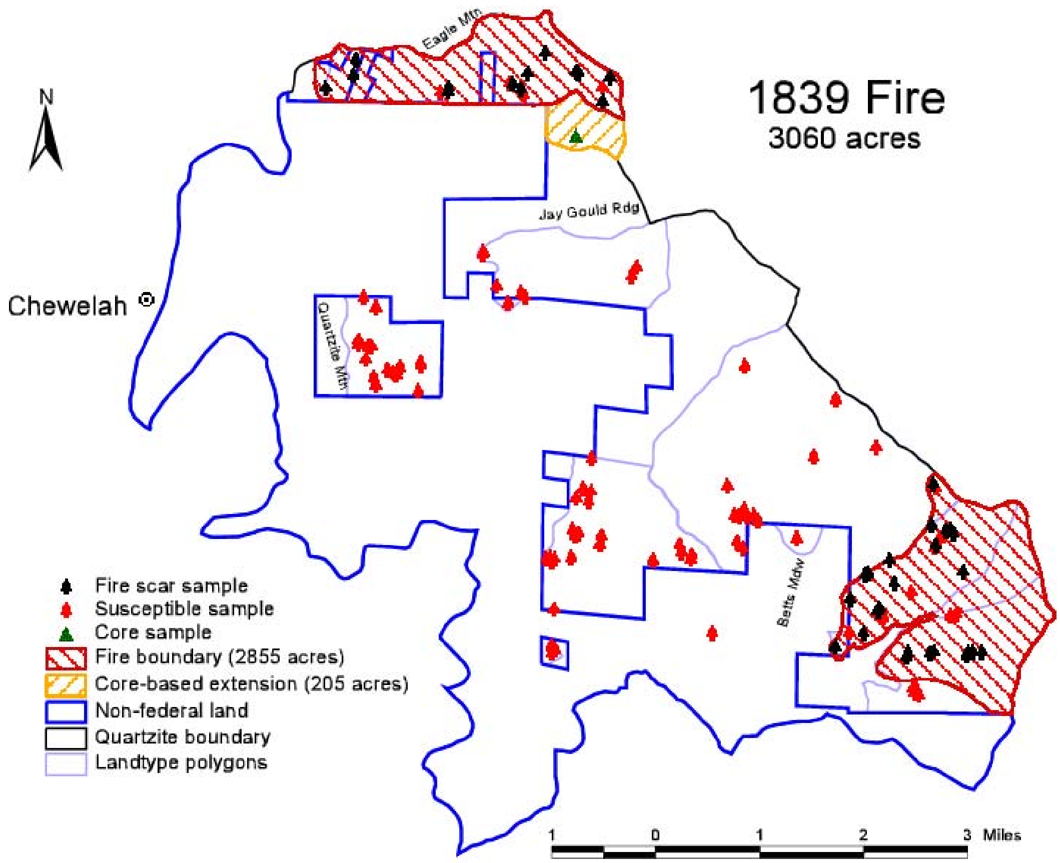

1848 Fire
415 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (415 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

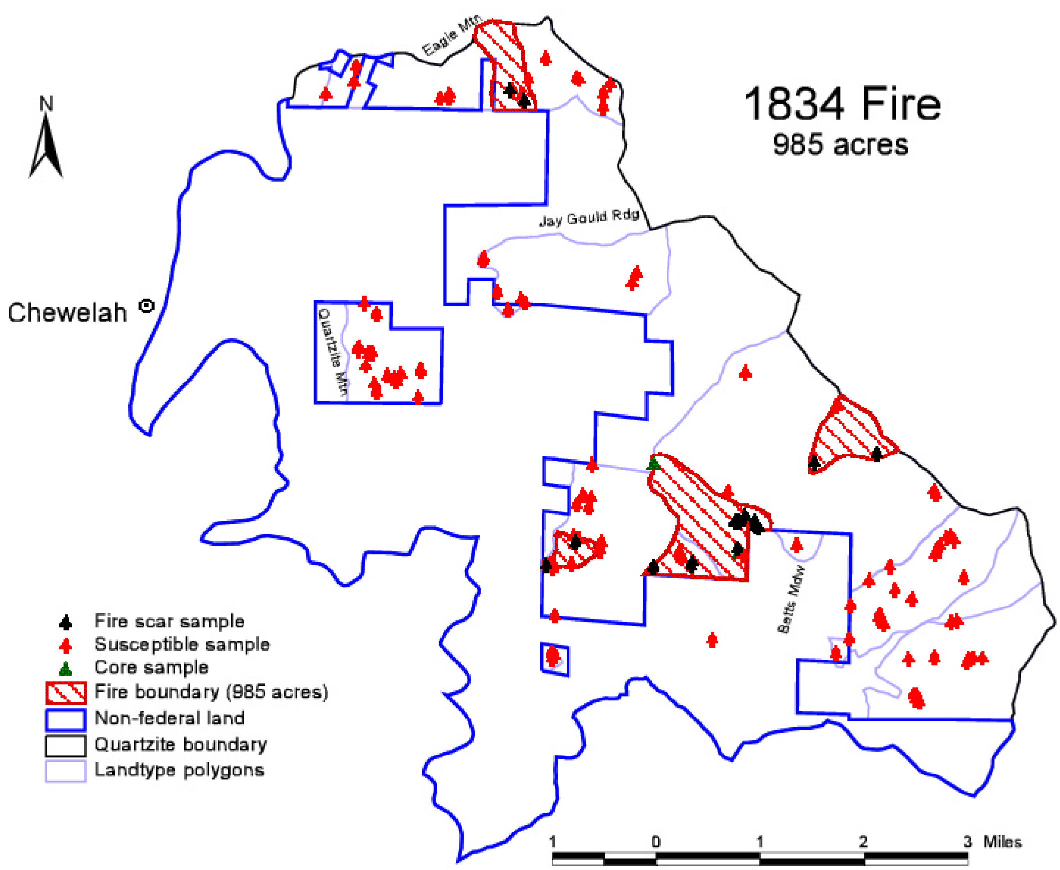

1846 Fire
199 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (191 acres)
Core-based extension (8 acres)
Non-federal land
Quartzite boundary
Landtype polygons
N
1 0 1 2 3 Miles

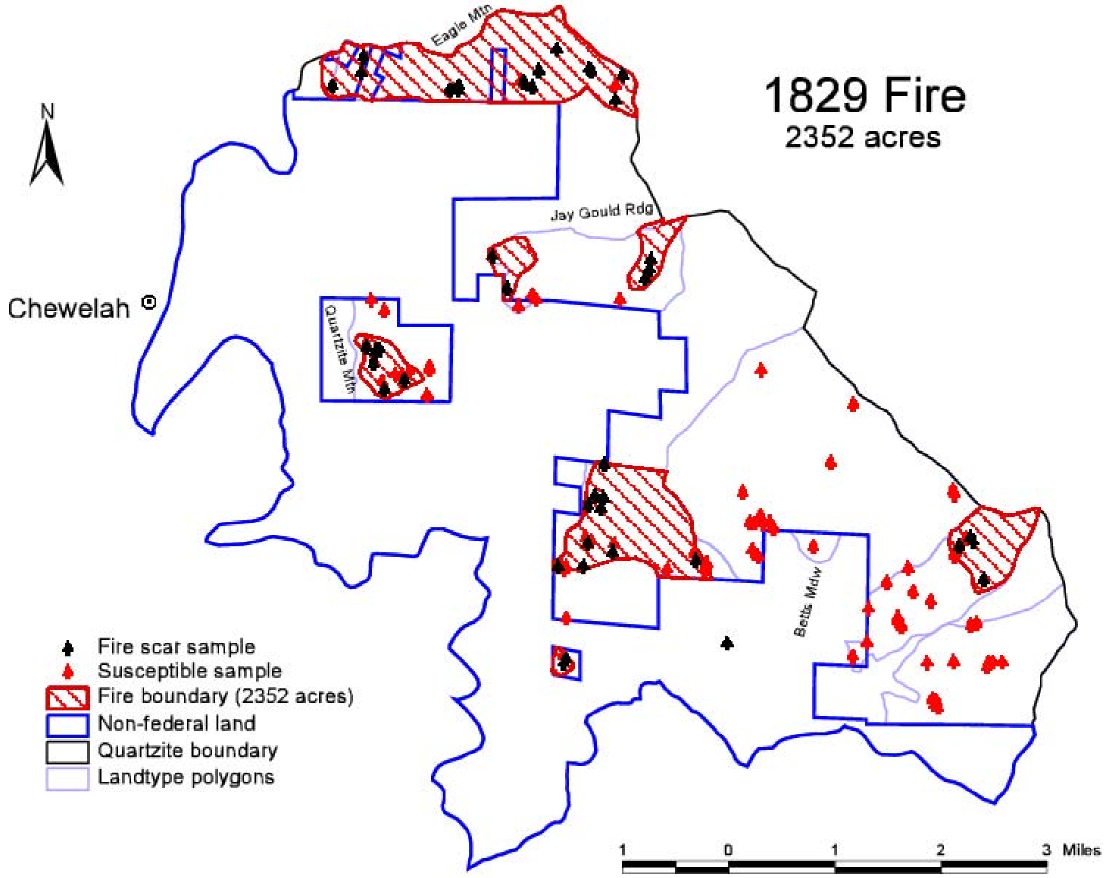

1844 Fire
428 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (428 acres)
Non-federal land
Quartzite boundary
Landtype polygons
N
1 0 1 2 3 Miles

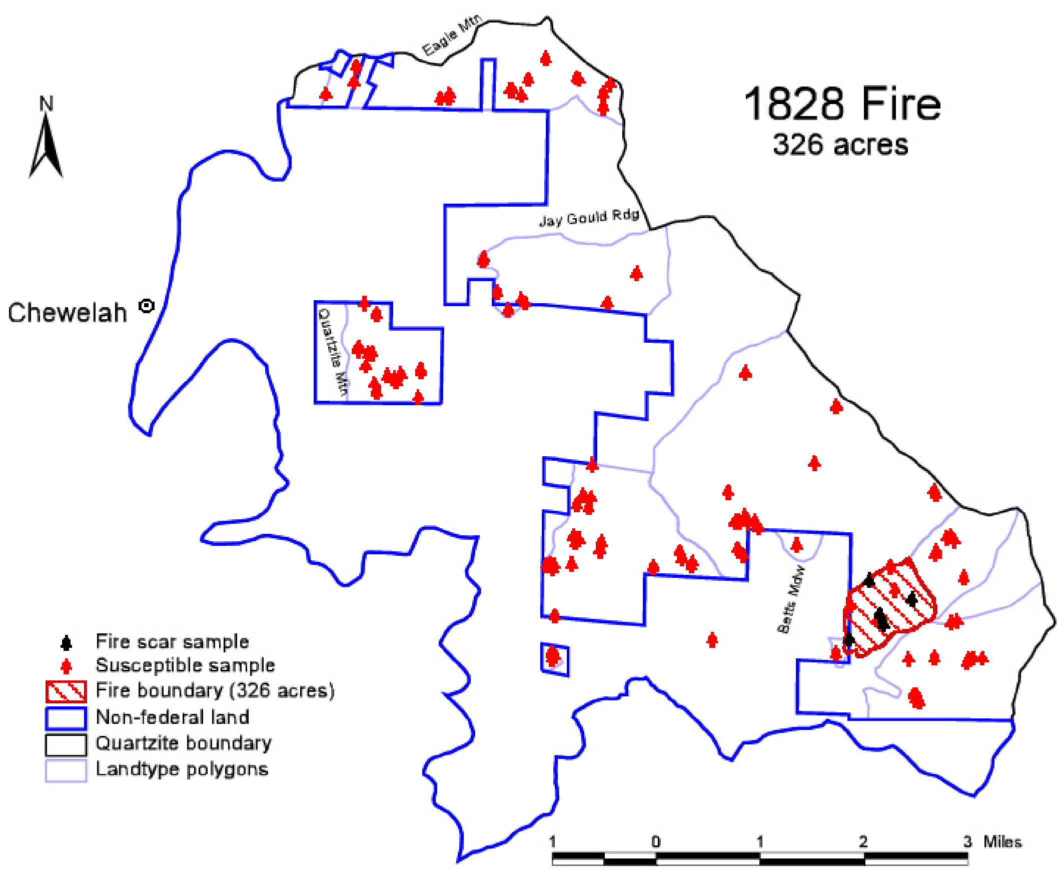

1842 Fire
18 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (18 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

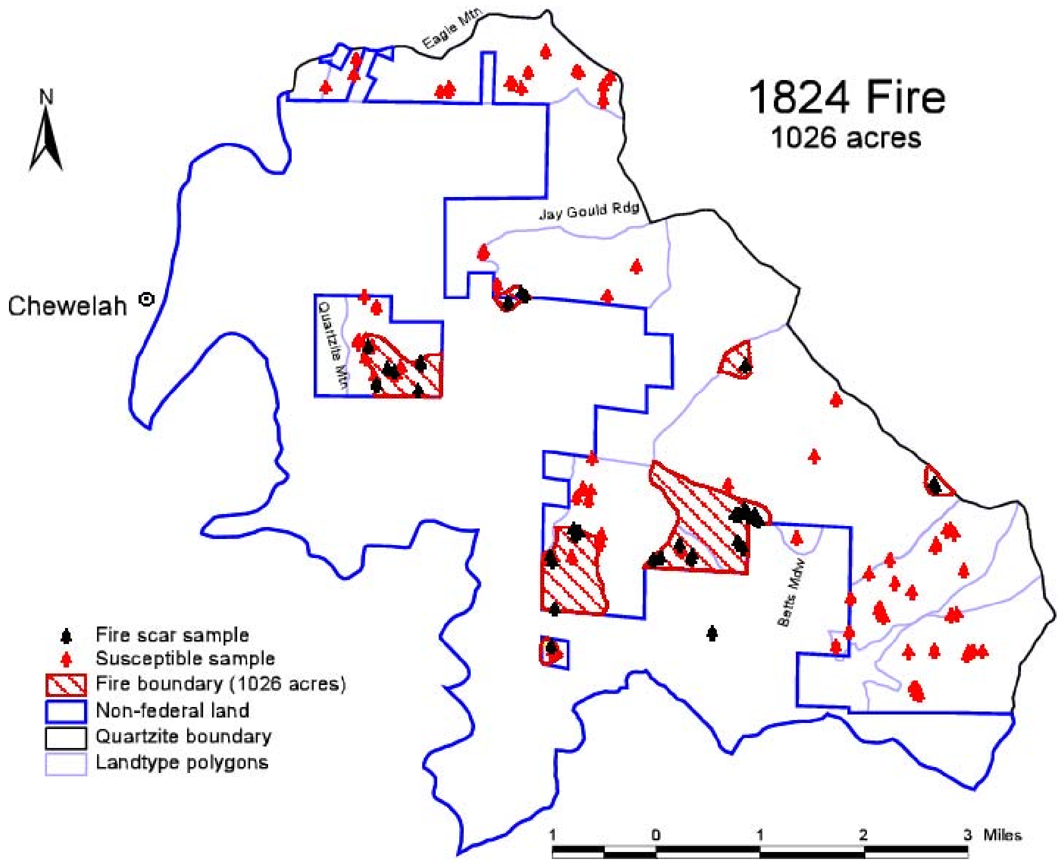

1841 Fire
3526 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (3526 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

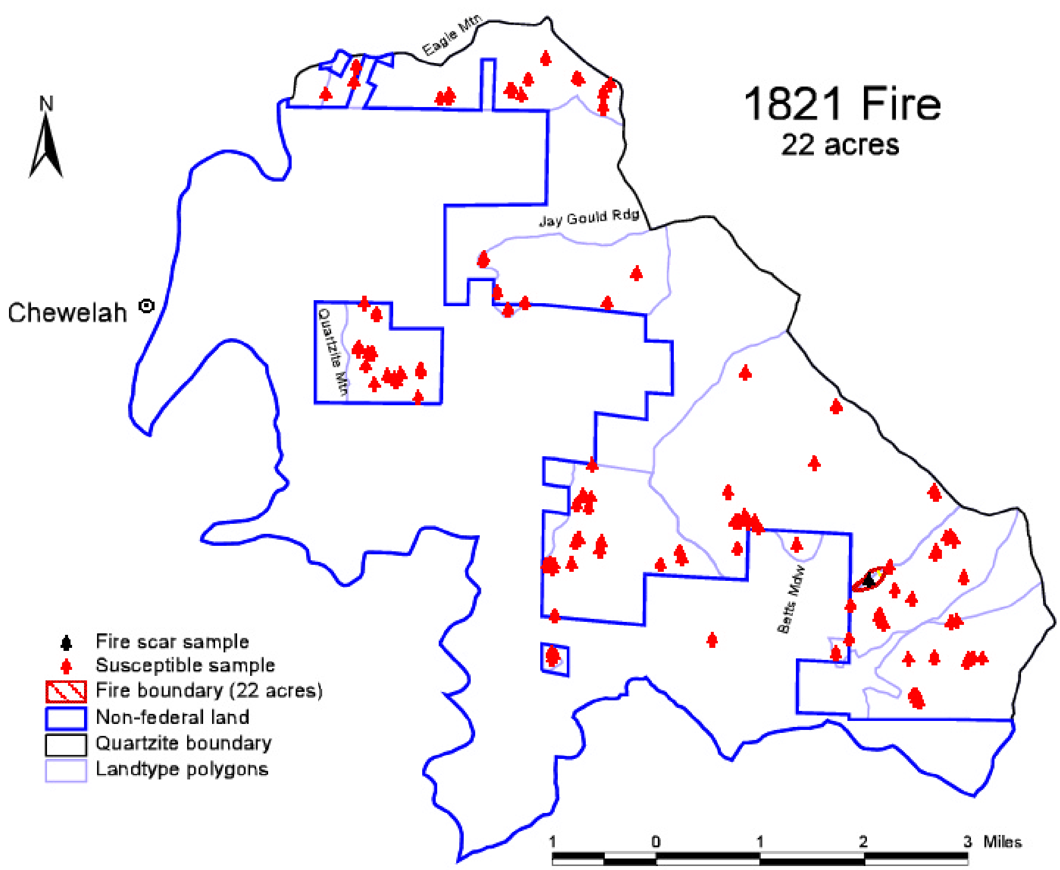

1839 Fire
3060 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (2855 acres)
Core-based extension (205 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

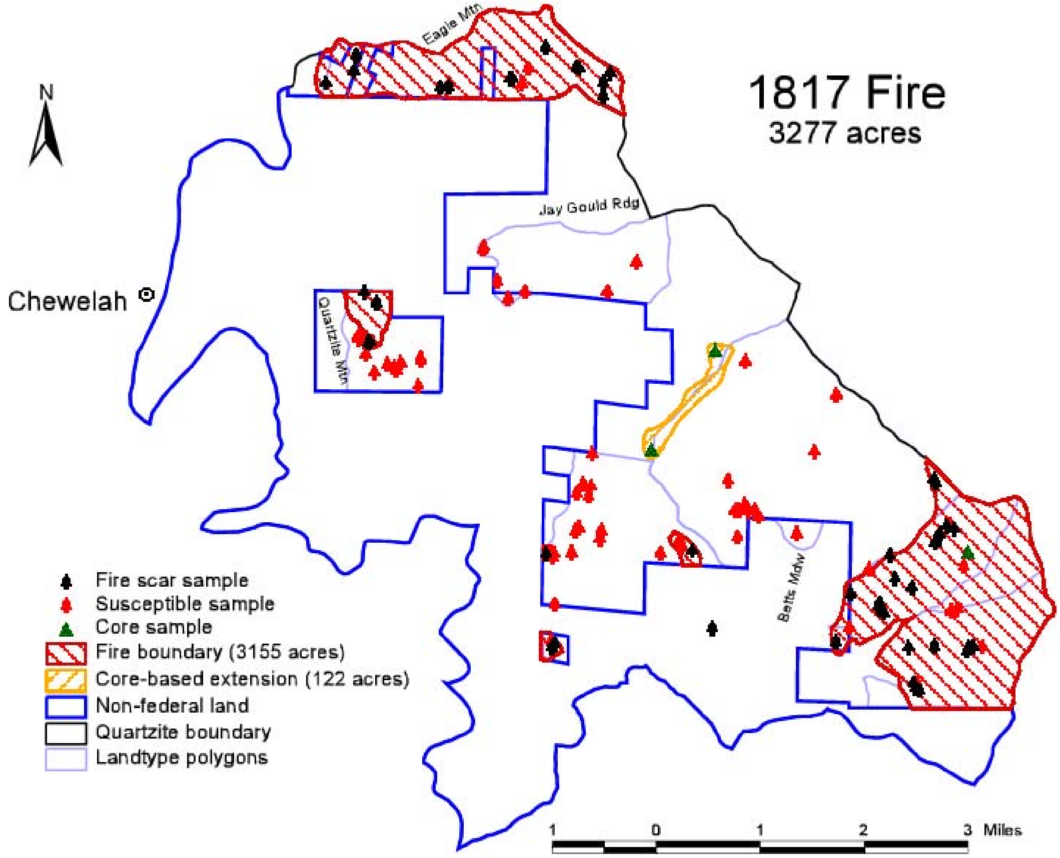

1834 Fire
985 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (985 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1829 Fire
2352 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (2352 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

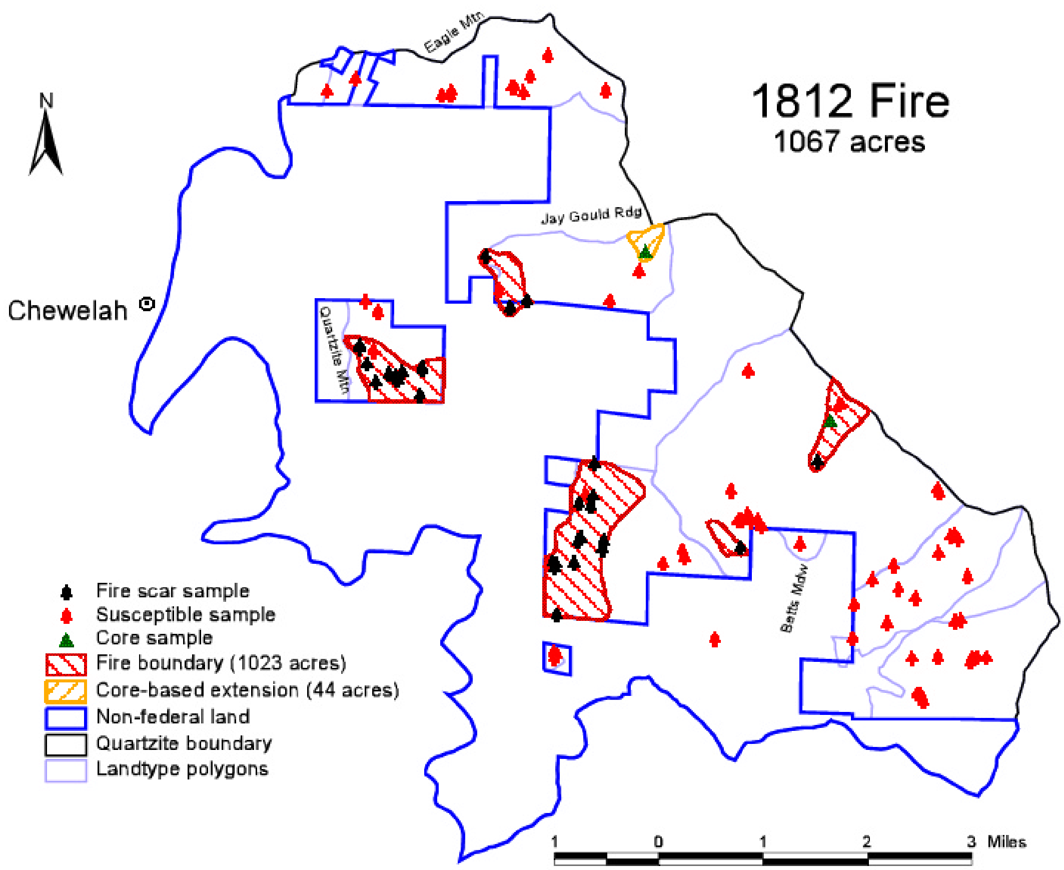

1828 Fire
326 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (326 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1824 Fire
1026 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (1026 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

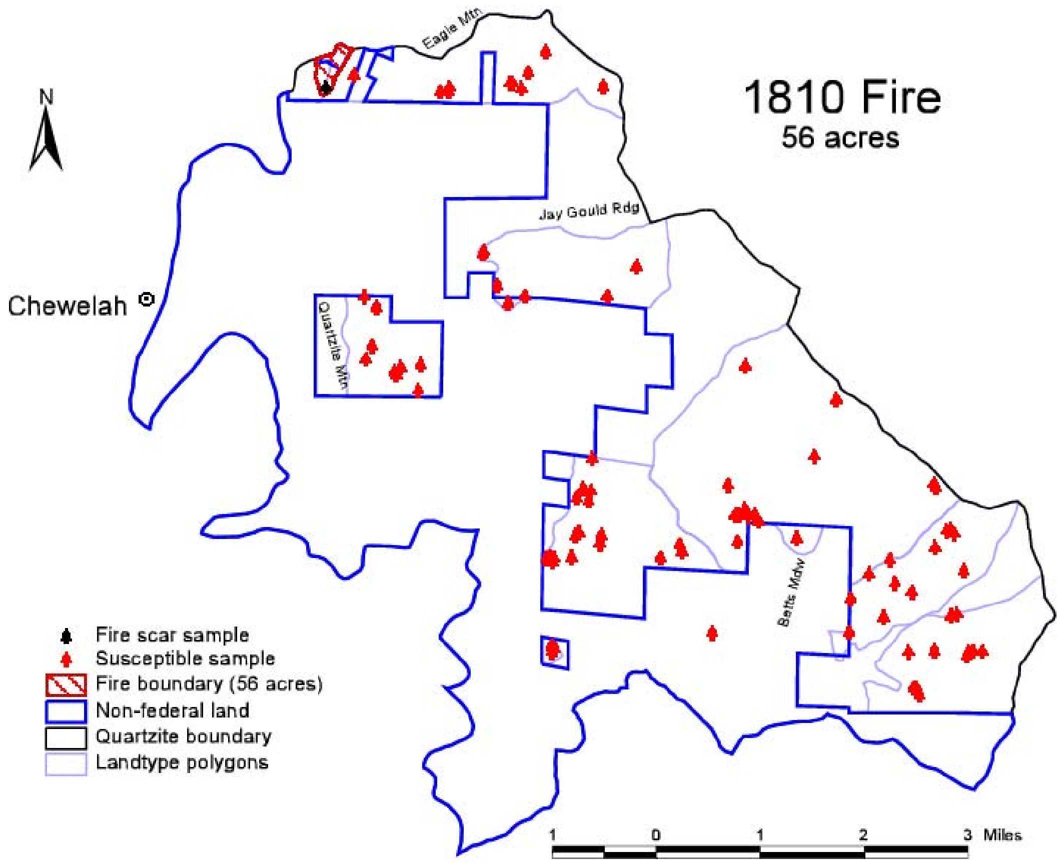

1821 Fire
22 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (22 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

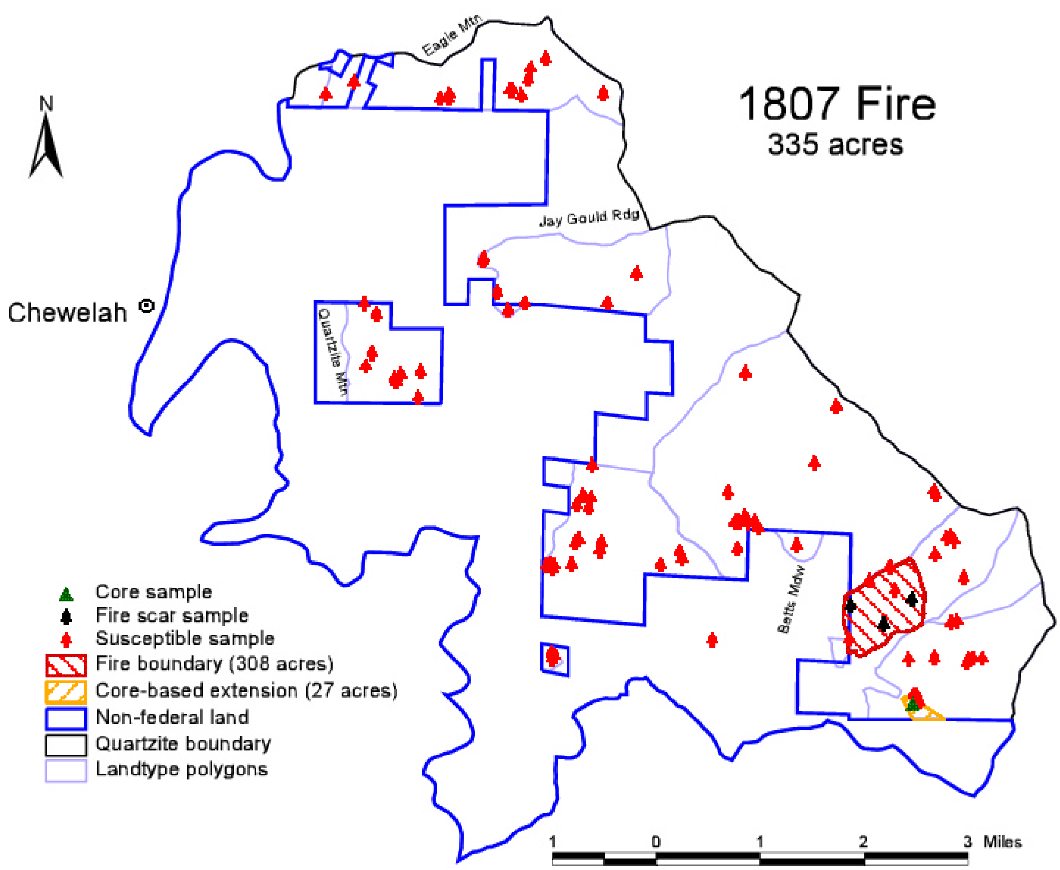


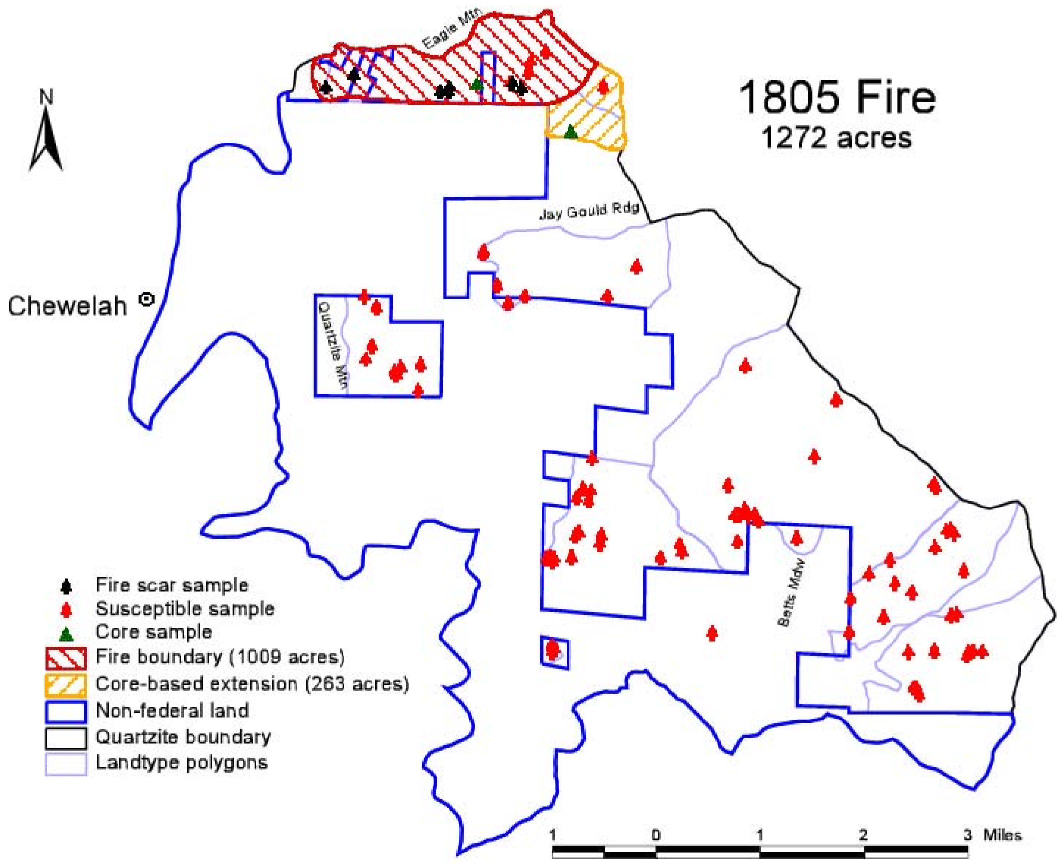
1817 Fire
3277 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (3155 acres)
Core-based extension (122 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

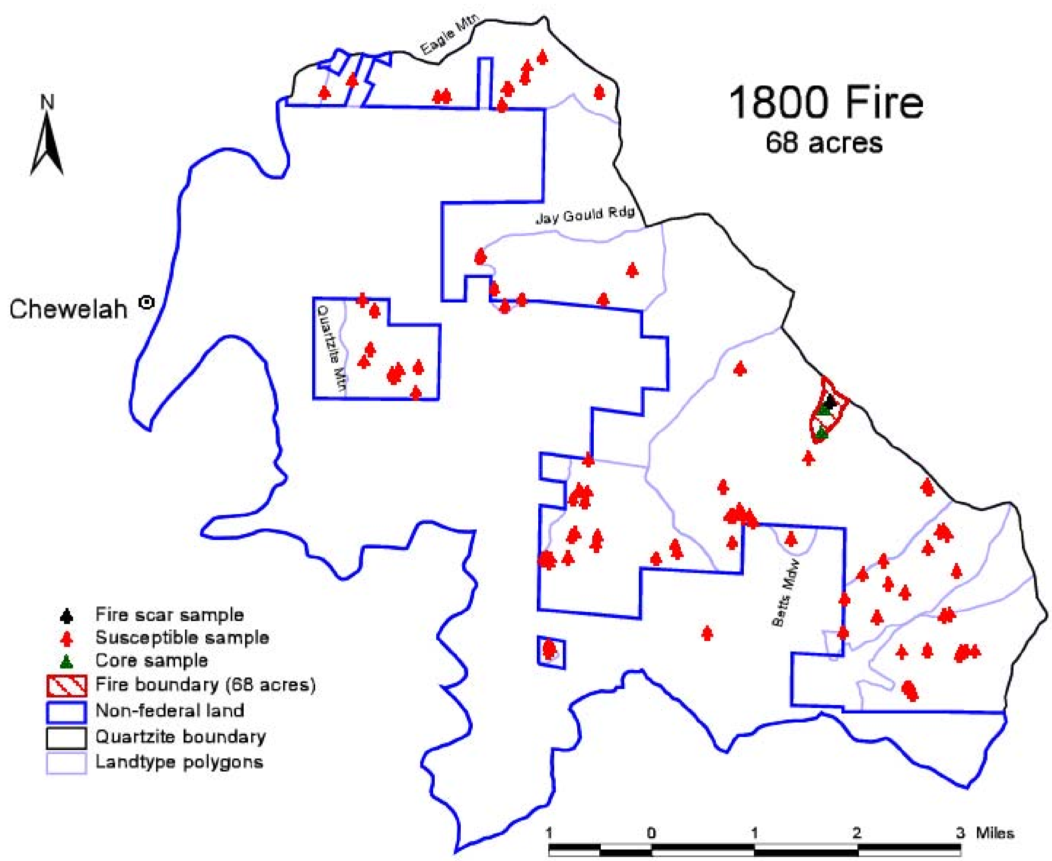


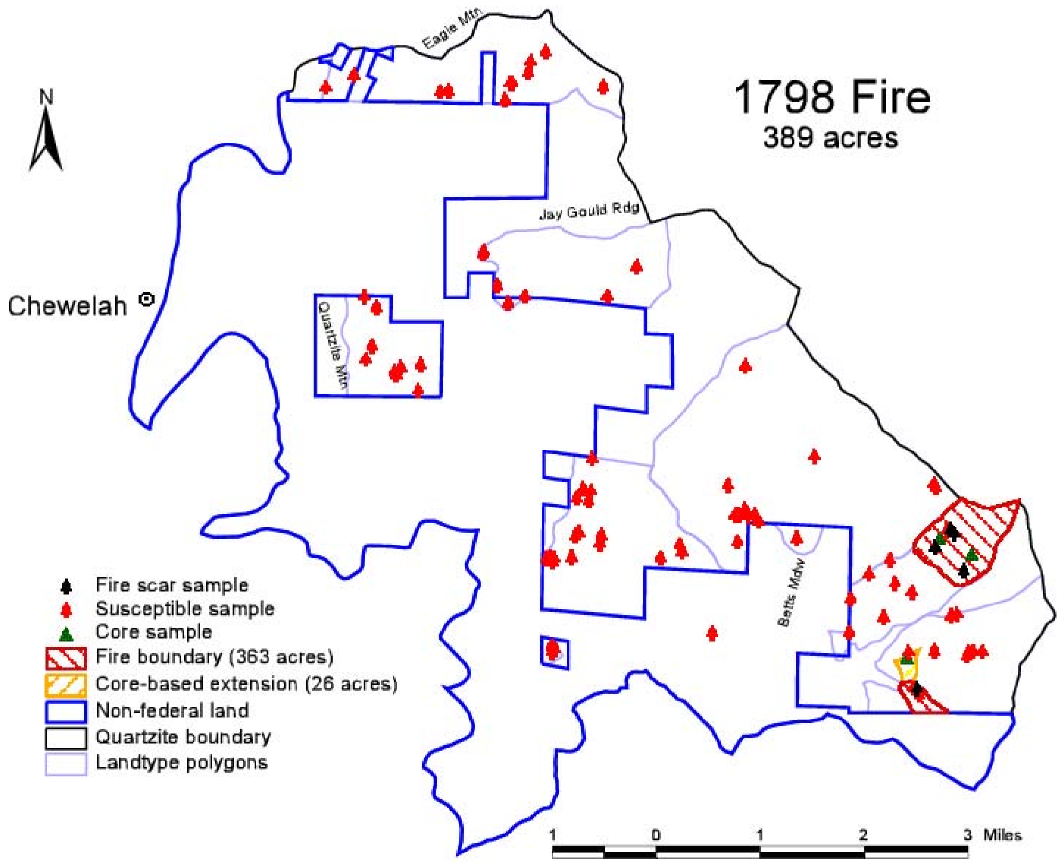
1812 Fire
1067 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1023 acres)
Core-based extension (44 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

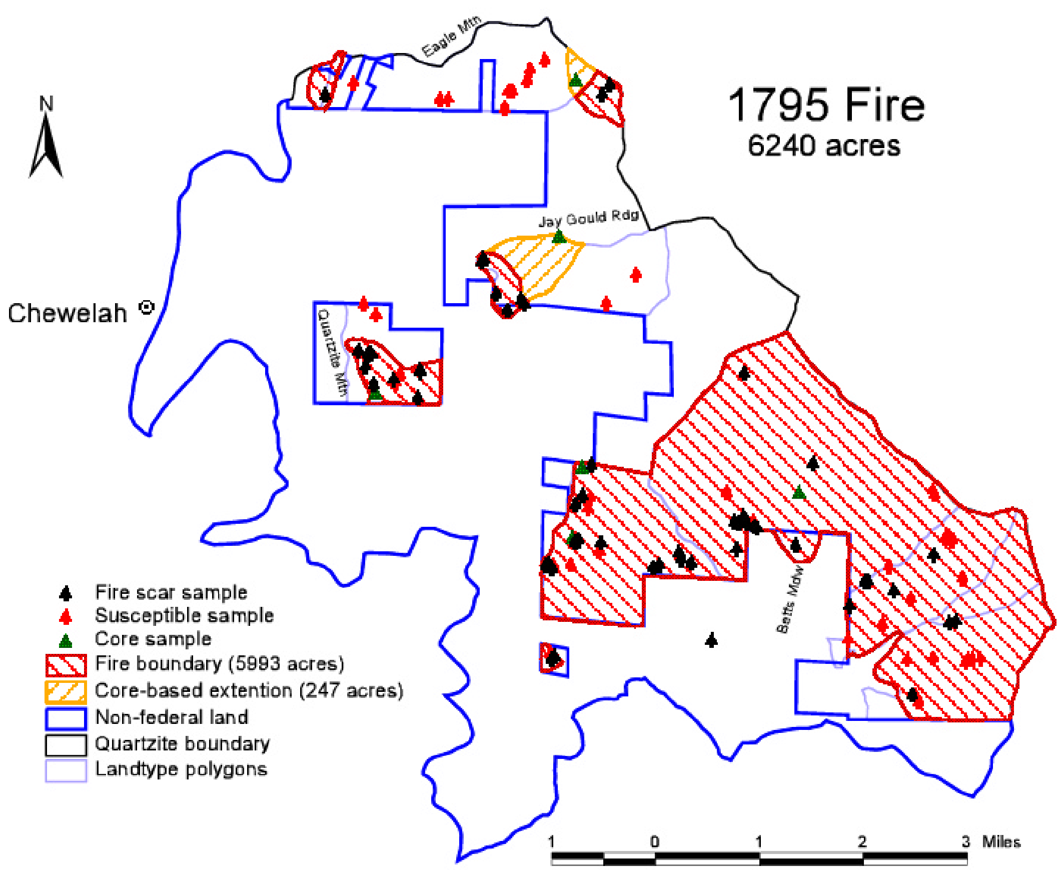

1810 Fire
56 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (56 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

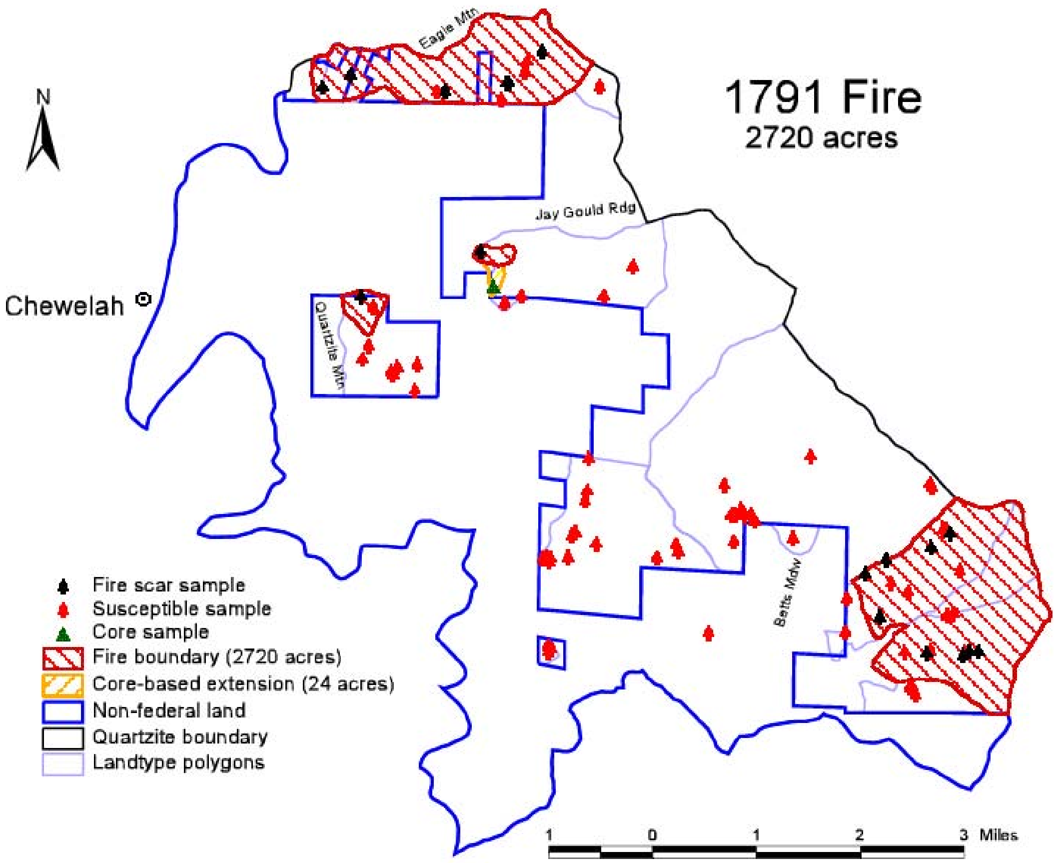

1807 Fire
335 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Core sample
Fire scar sample
Susceptible sample
Fire boundary (308 acres)
Core-based extension (27 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

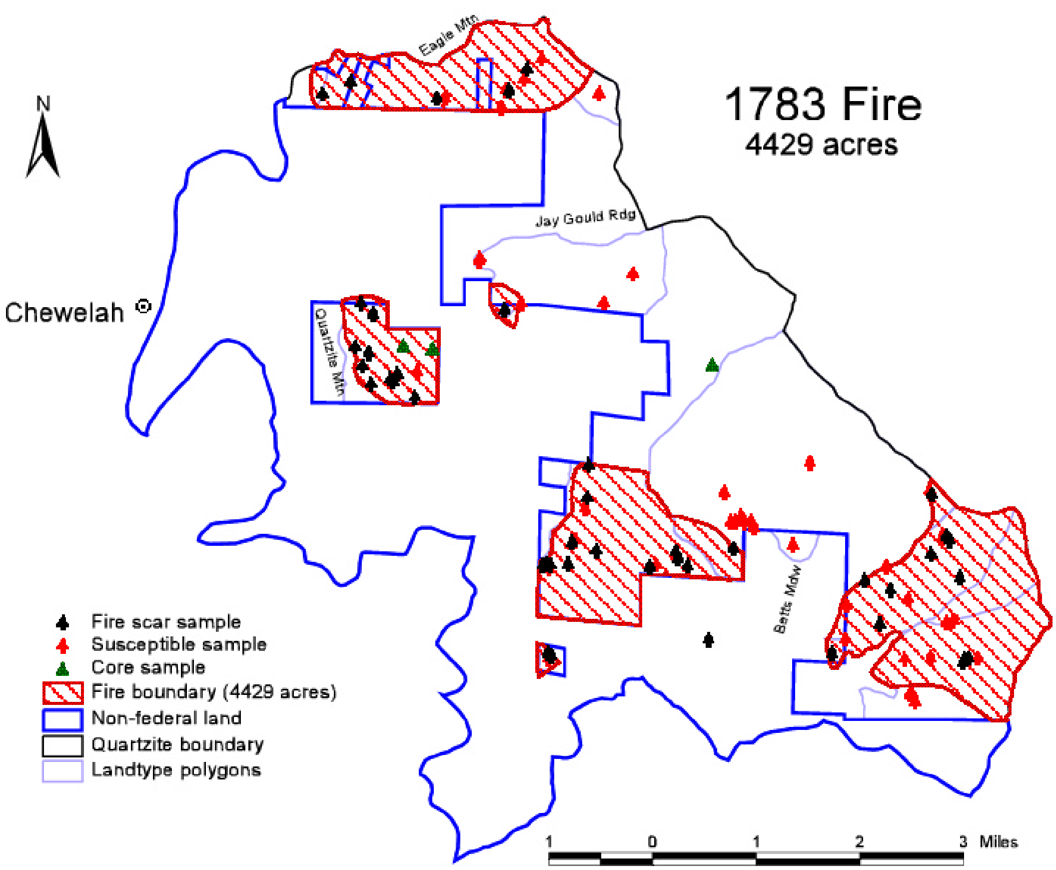

1805 Fire
1272 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1009 acres)
Core-based extension (263 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

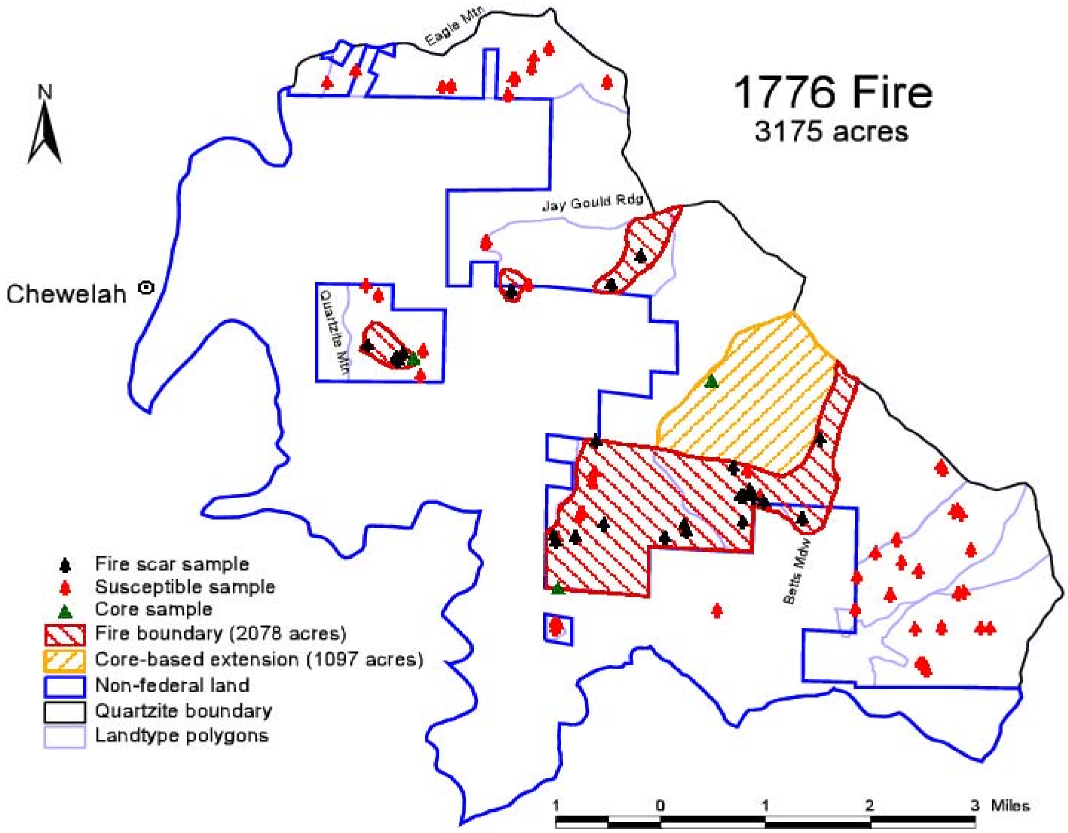

1800 Fire
68 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (68 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

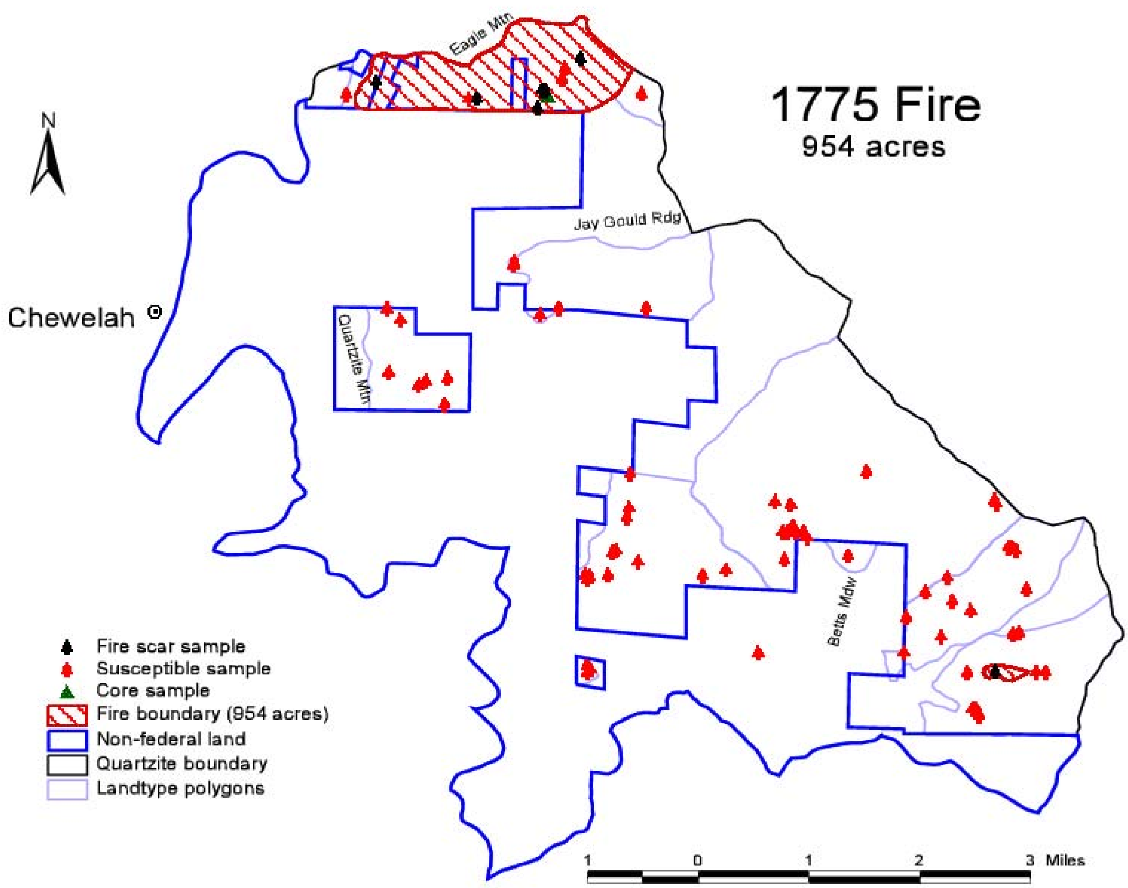

1798 Fire
389 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (363 acres)
Core-based extension (26 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

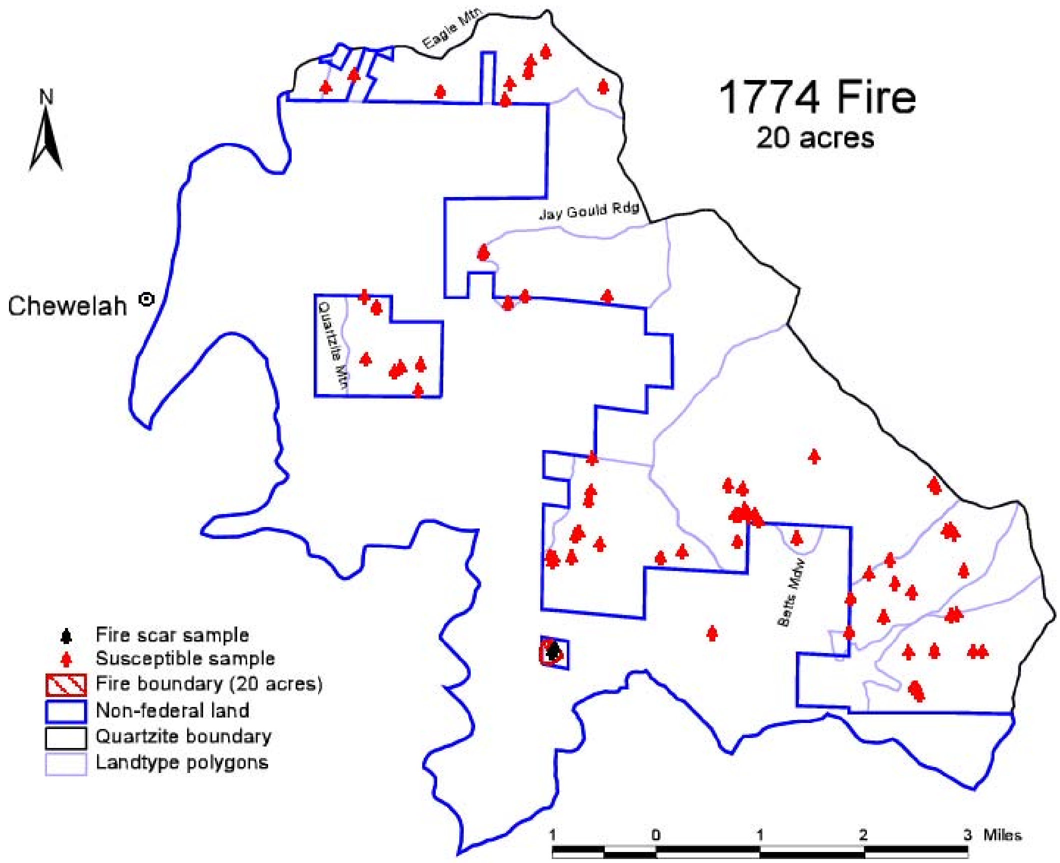

1795 Fire
6240 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (5993 acres)
Core-based extention (247 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

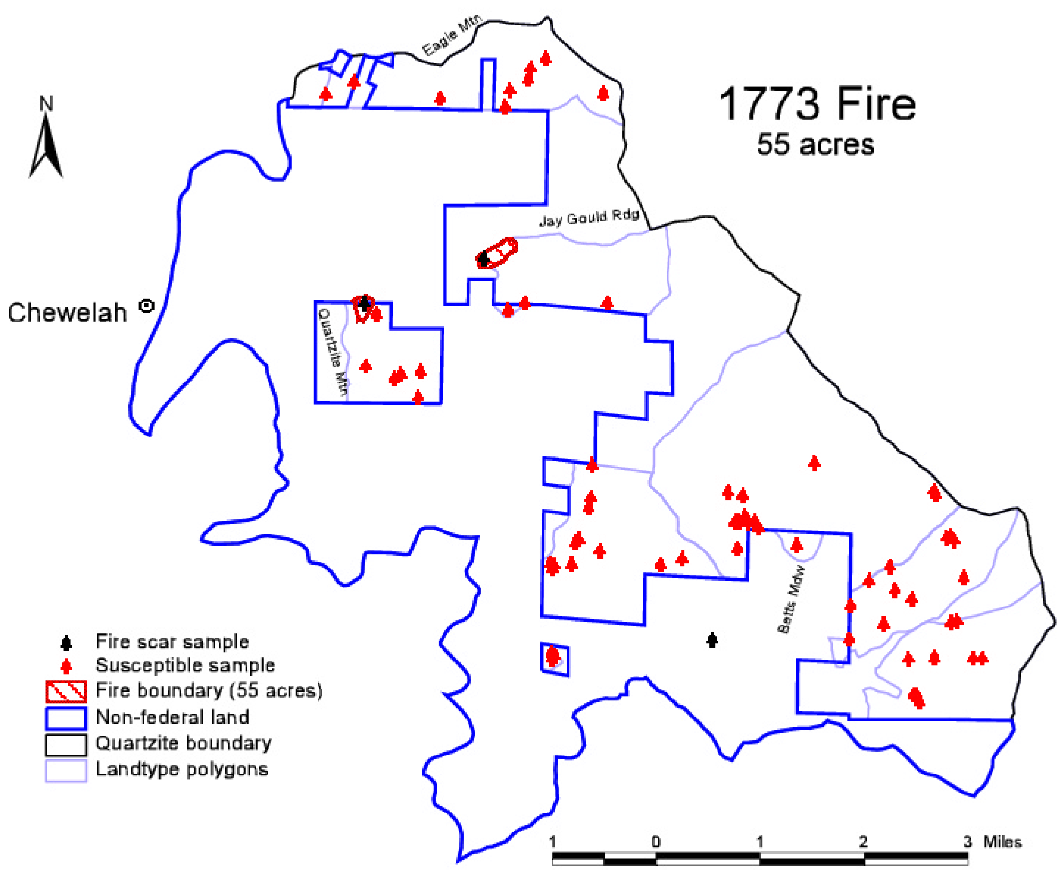

1791 Fire
2720 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (2720 acres)
Core-based extension (24 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

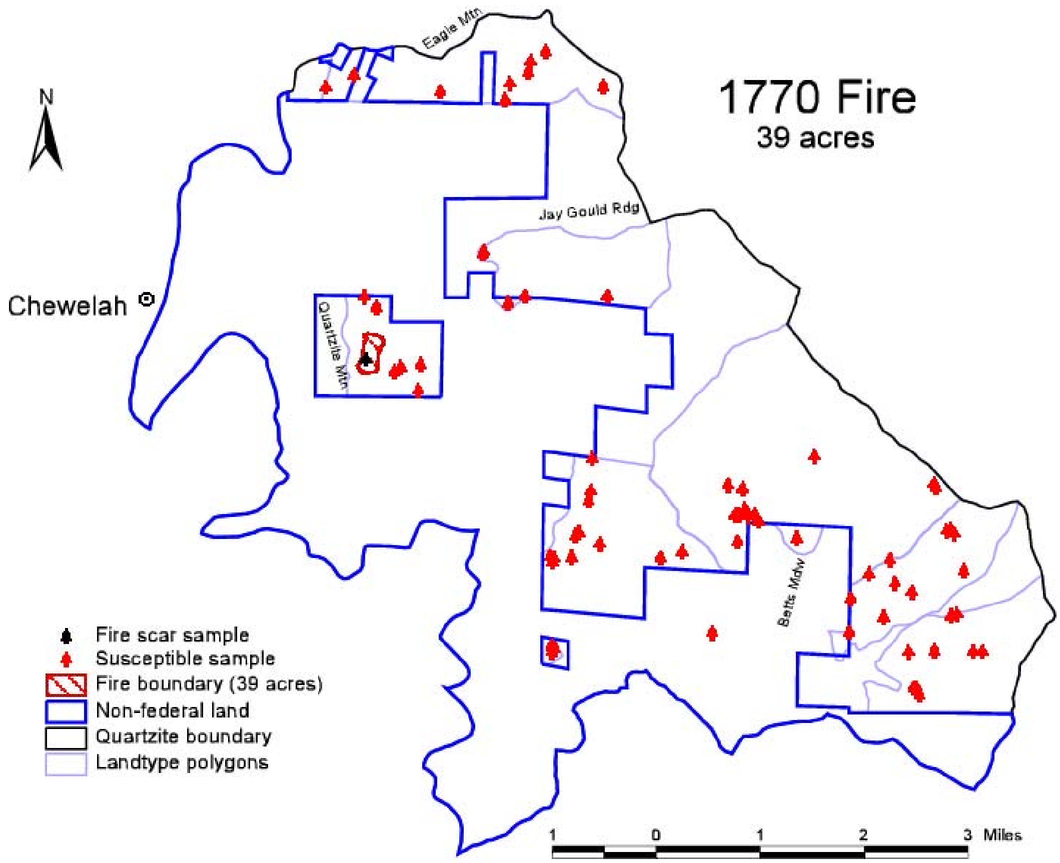

1783 Fire
4429 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (4429 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1776 Fire
3175 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (2078 acres)
Core-based extension (1097 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

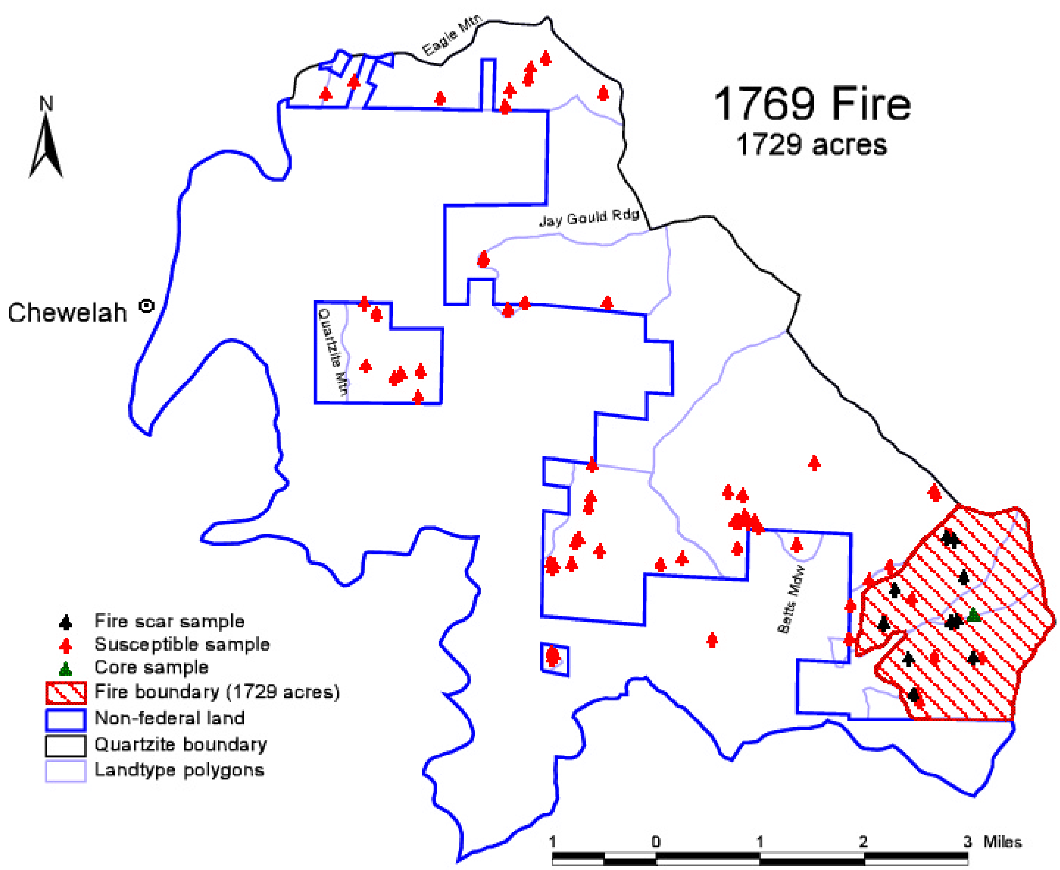

1775 Fire
954 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (954 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1774 Fire
20 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (20 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

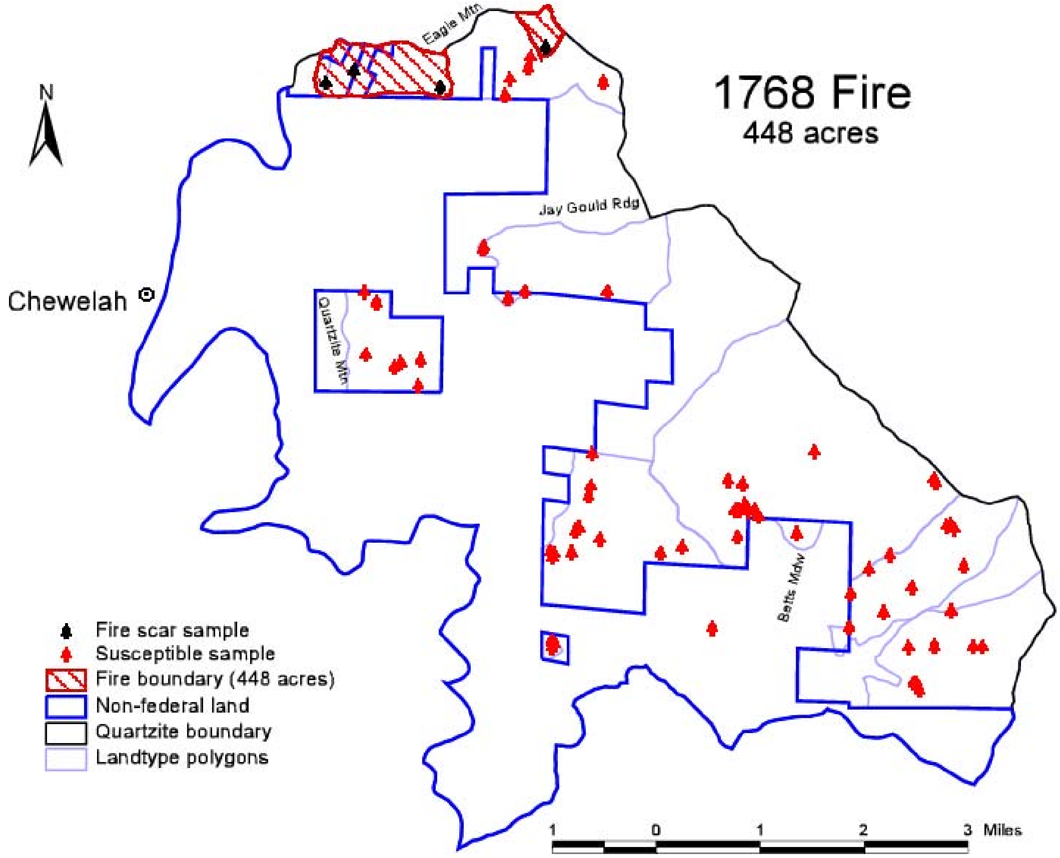

1773 Fire
55 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (55 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

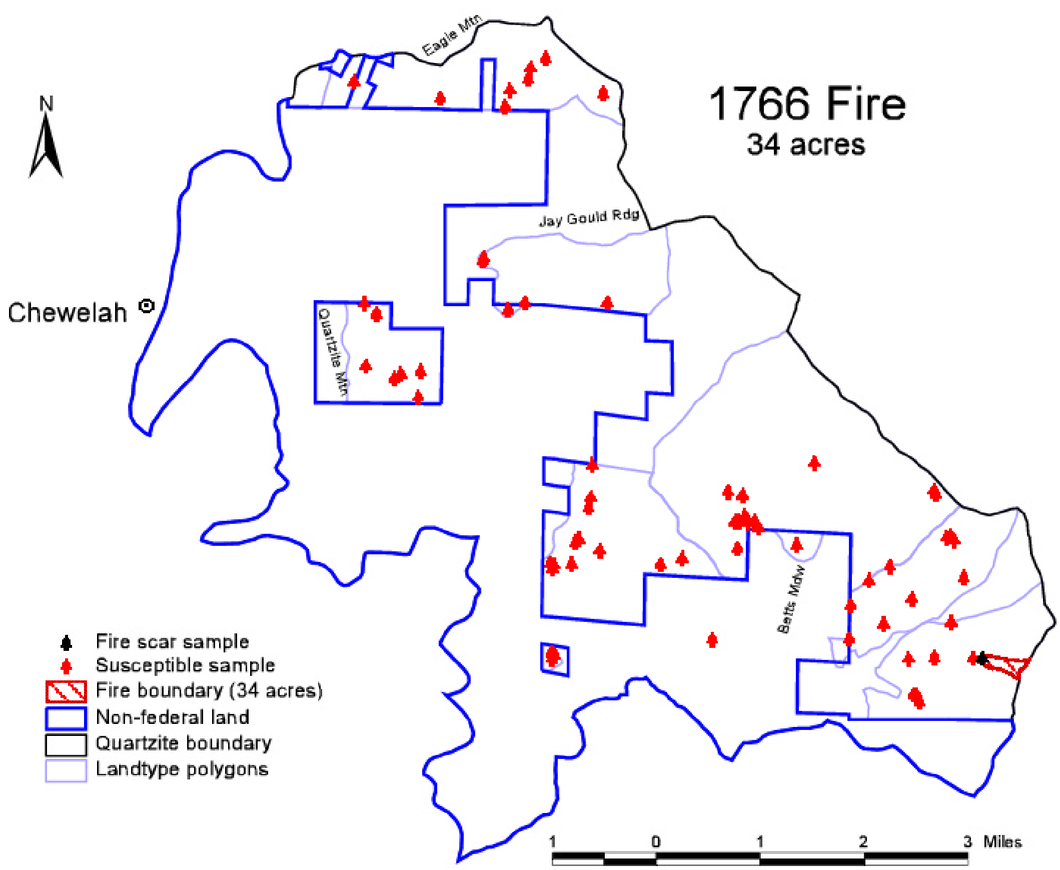


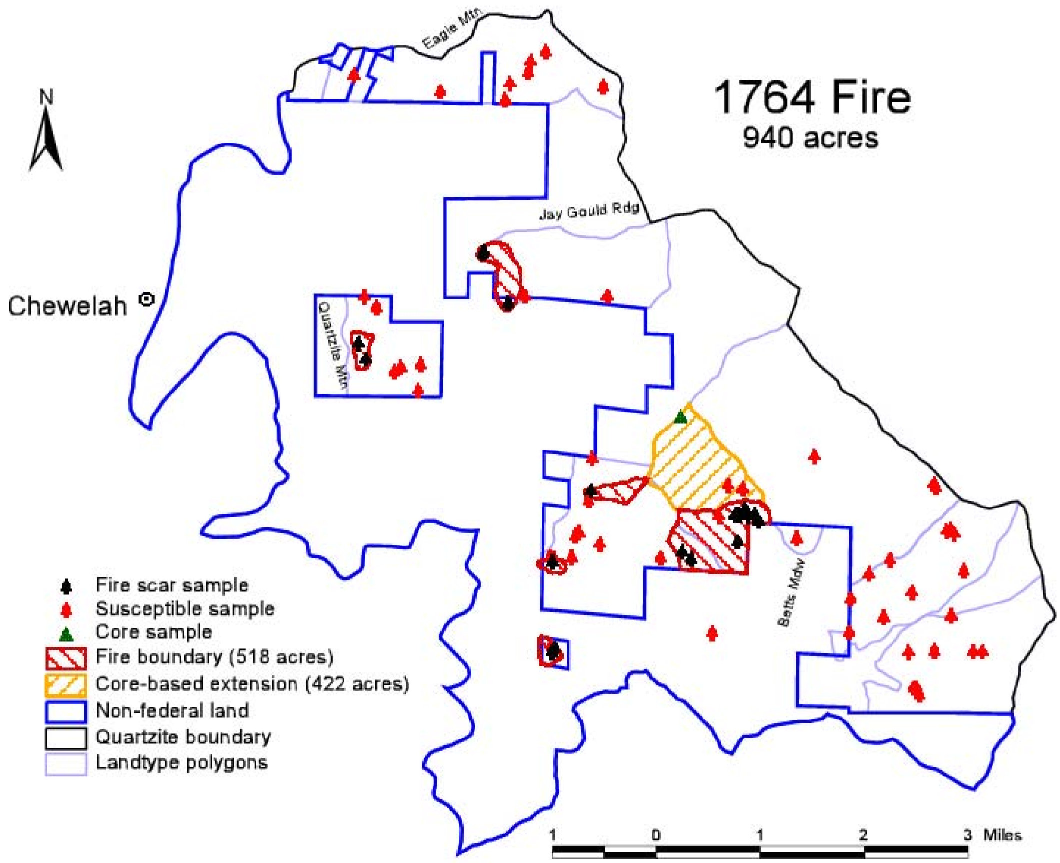
1770 Fire
39 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (39 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles



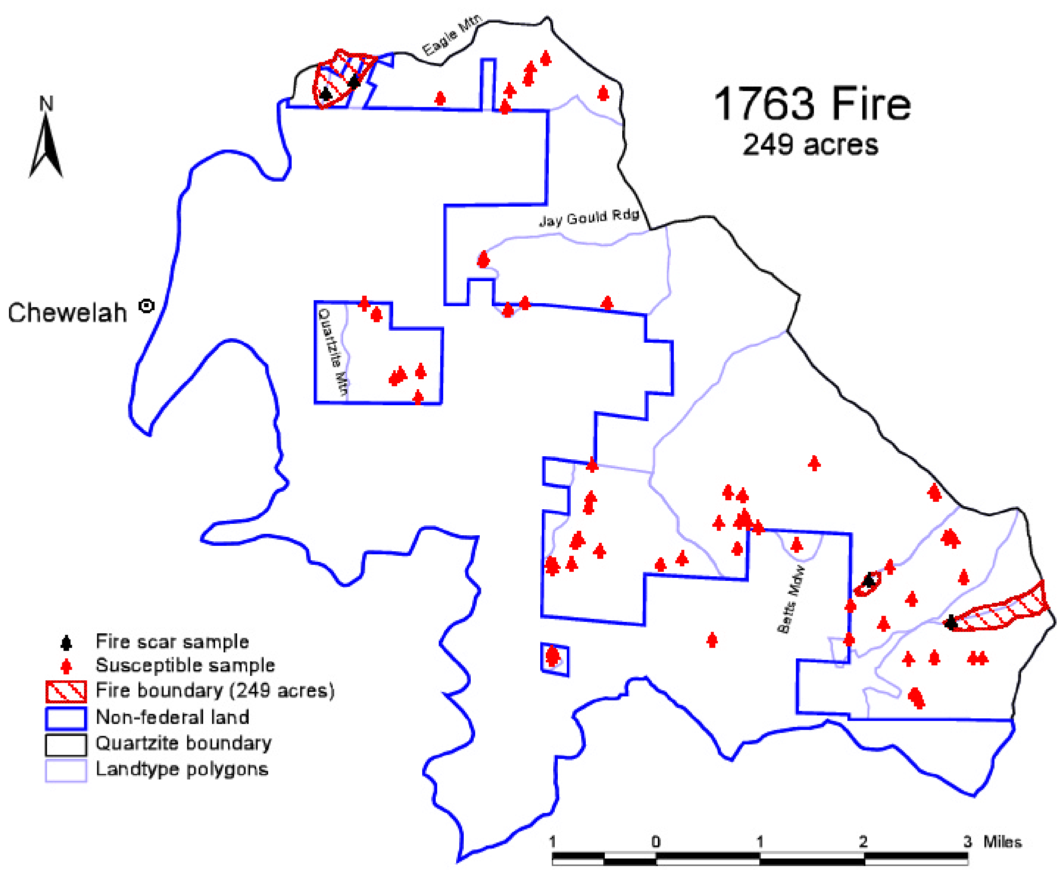
1769 Fire
1729 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1729 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1768 Fire
448 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (448 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

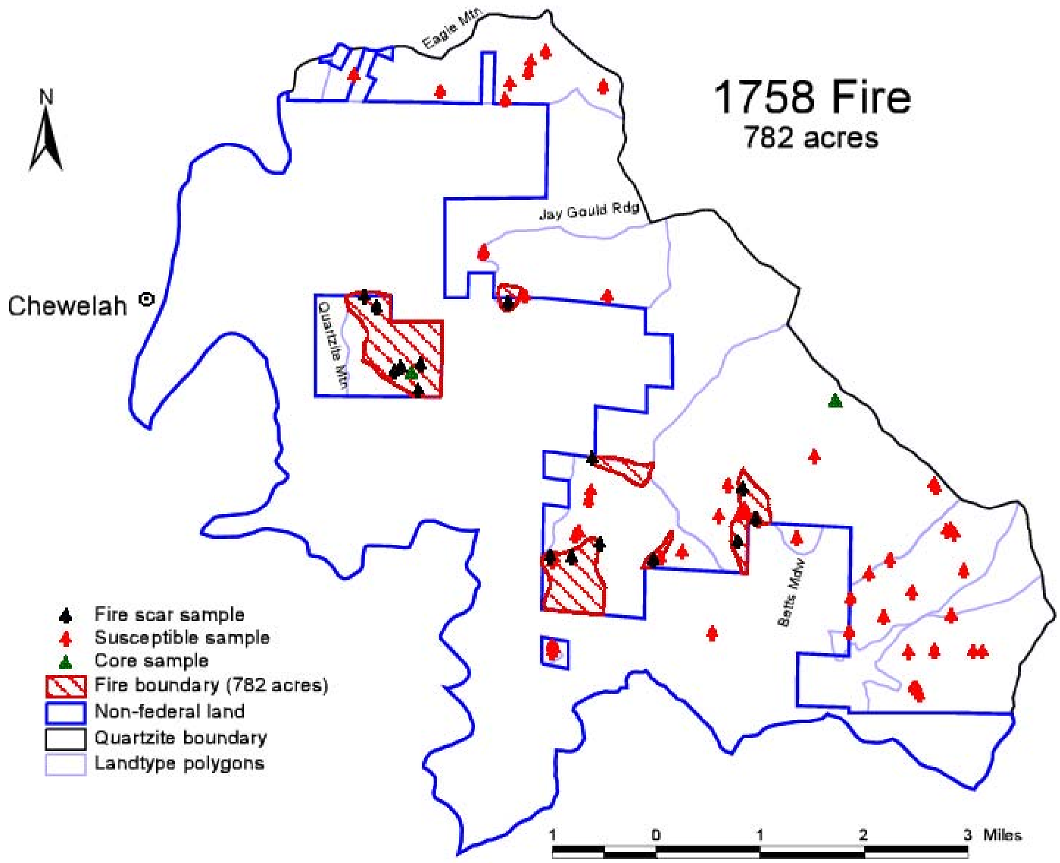

1766 Fire
34 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (34 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

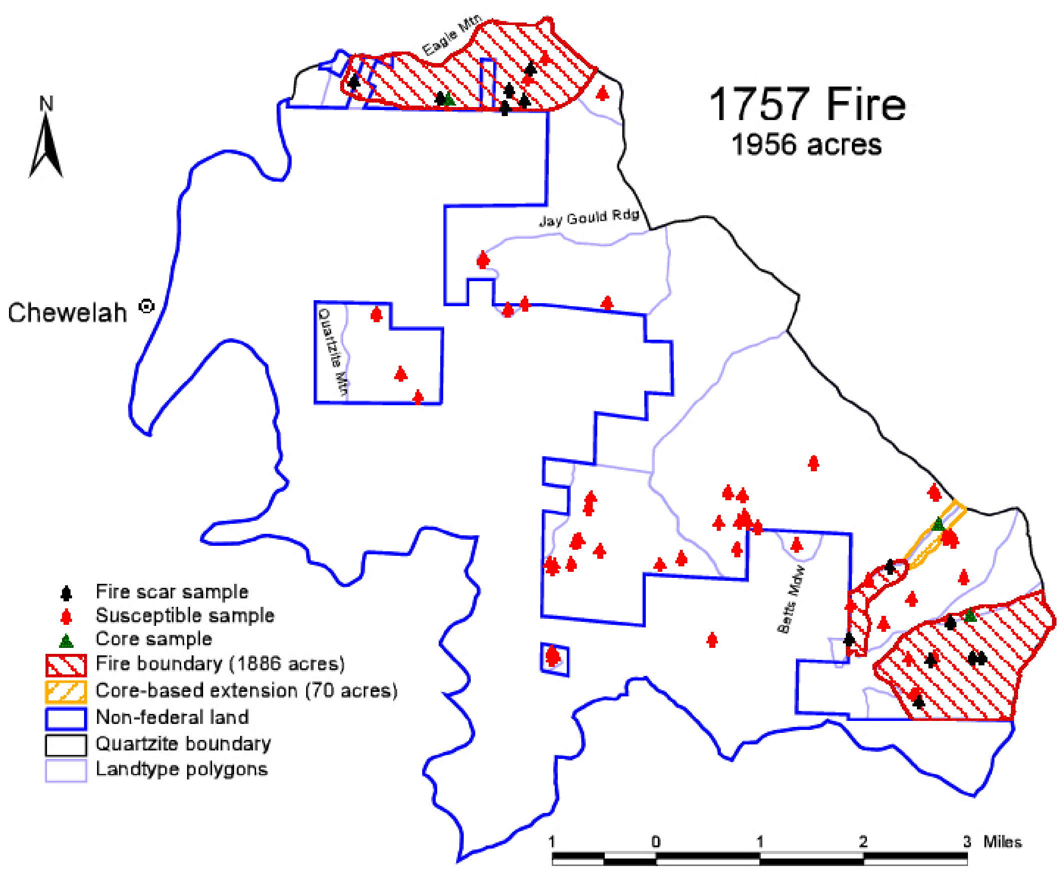


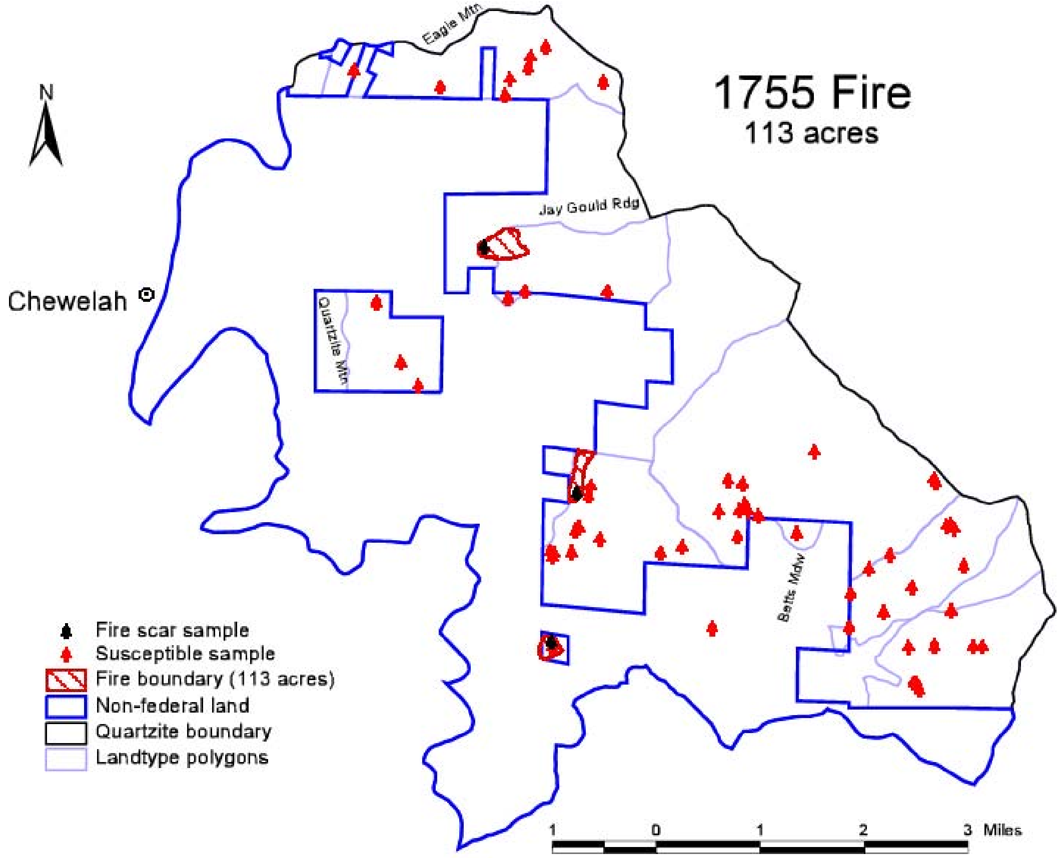
1764 Fire
940 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (518 acres)
Core-based extension (422 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3 Miles

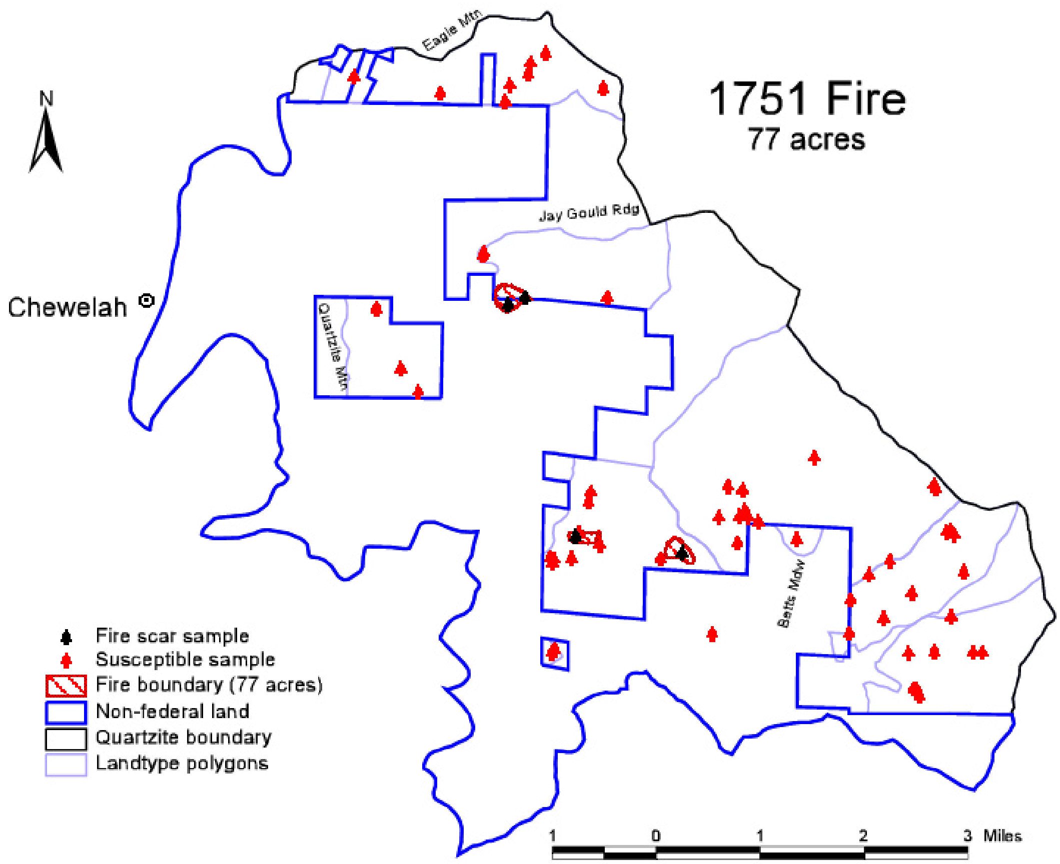


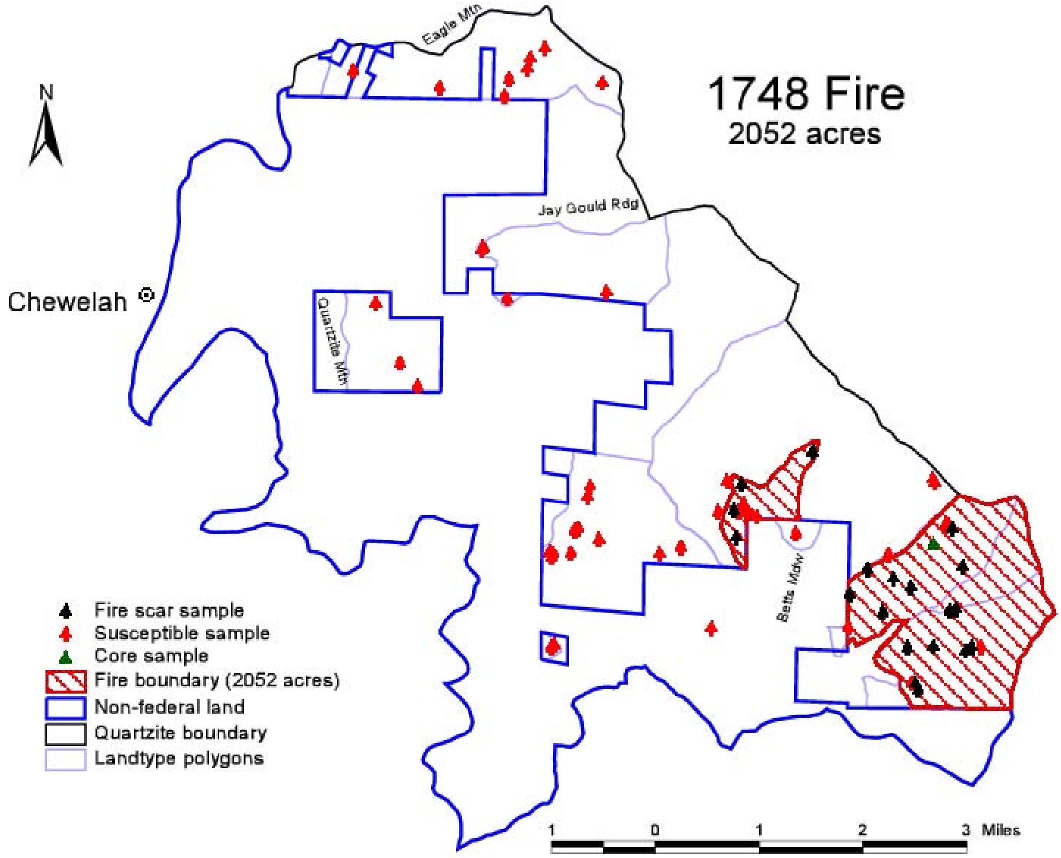
1763 Fire
249 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (249 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3 Miles

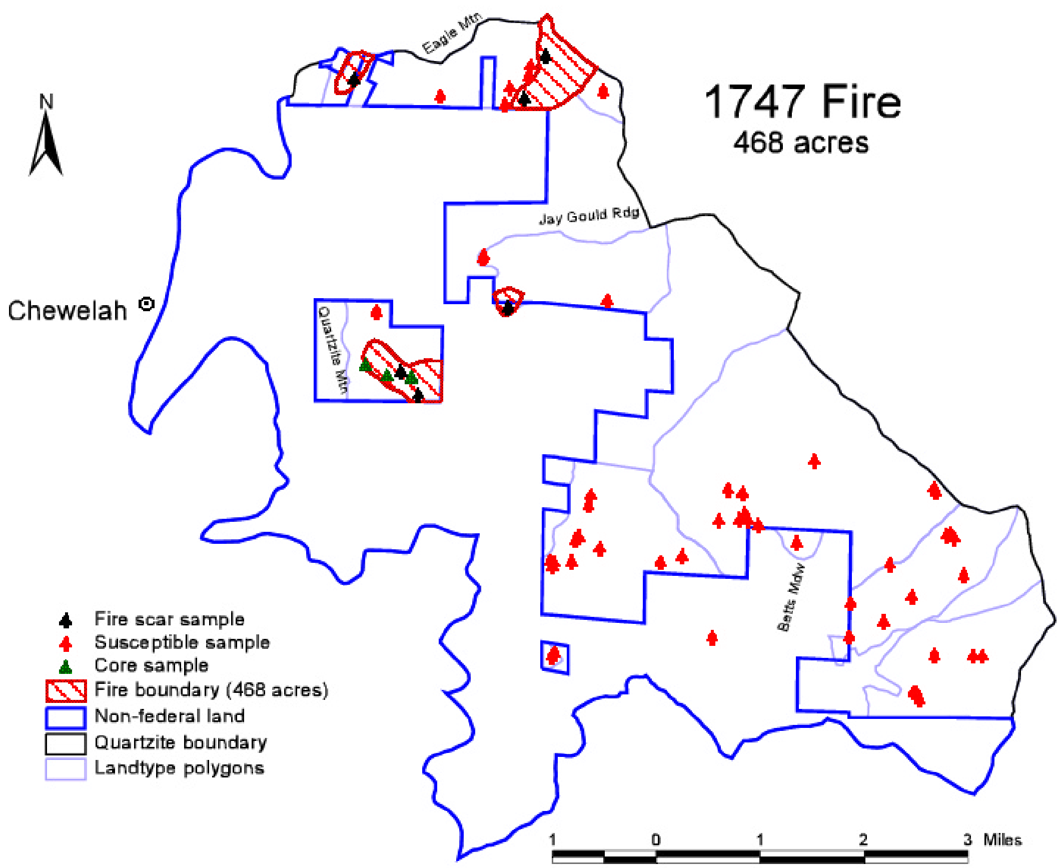

1758 Fire
782 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (782 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

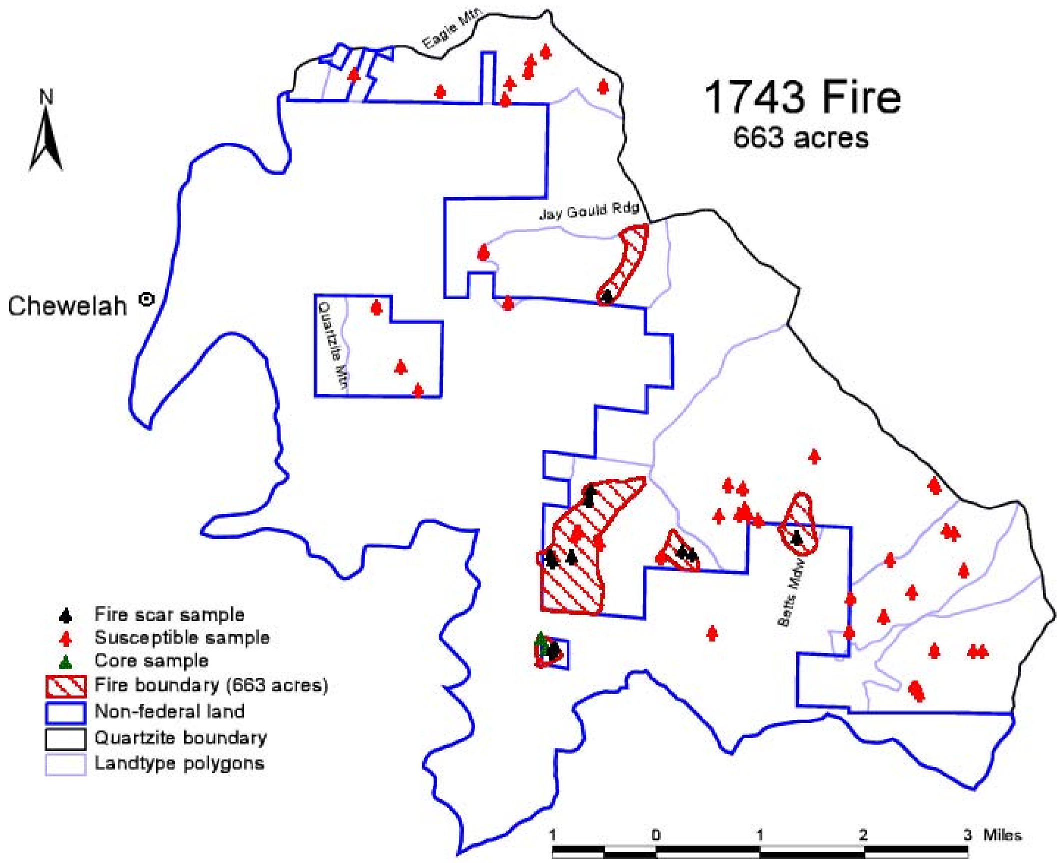

1757 Fire
1956 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1886 acres)
Core-based extension (70 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1755 Fire
113 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (113 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

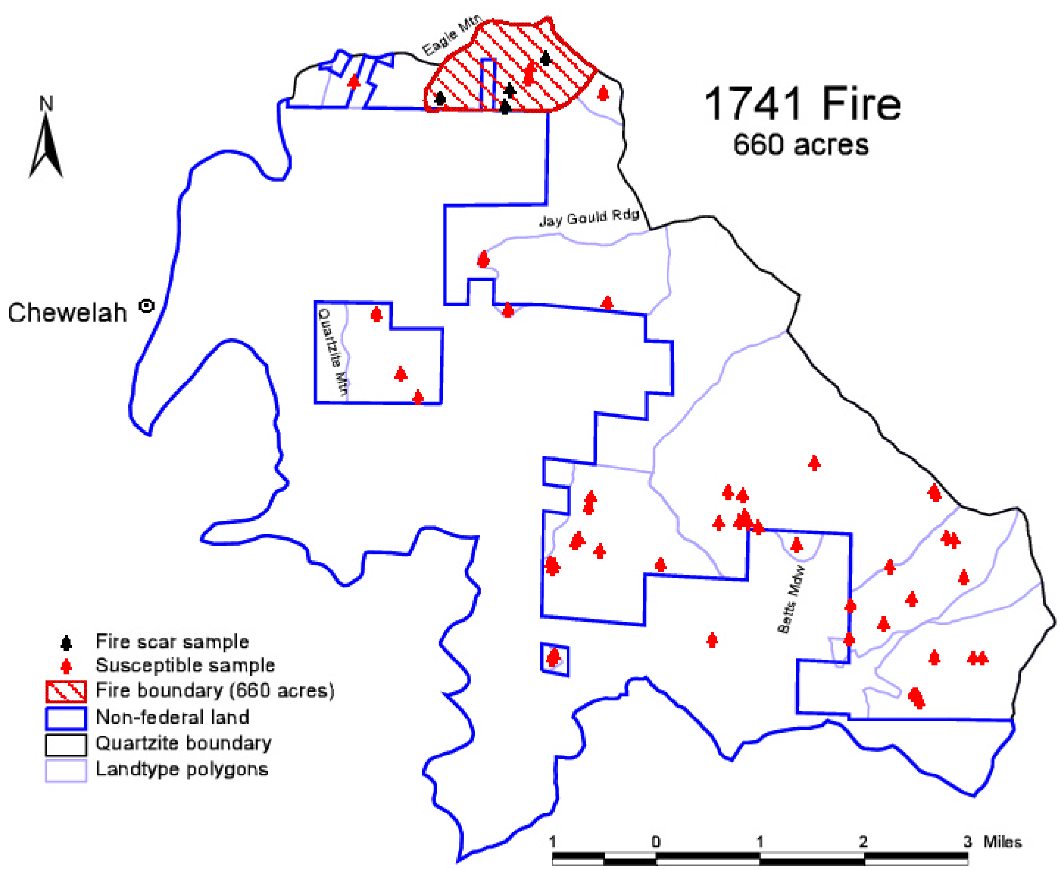

1751 Fire
77 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (77 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1748 Fire
2052 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (2052 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

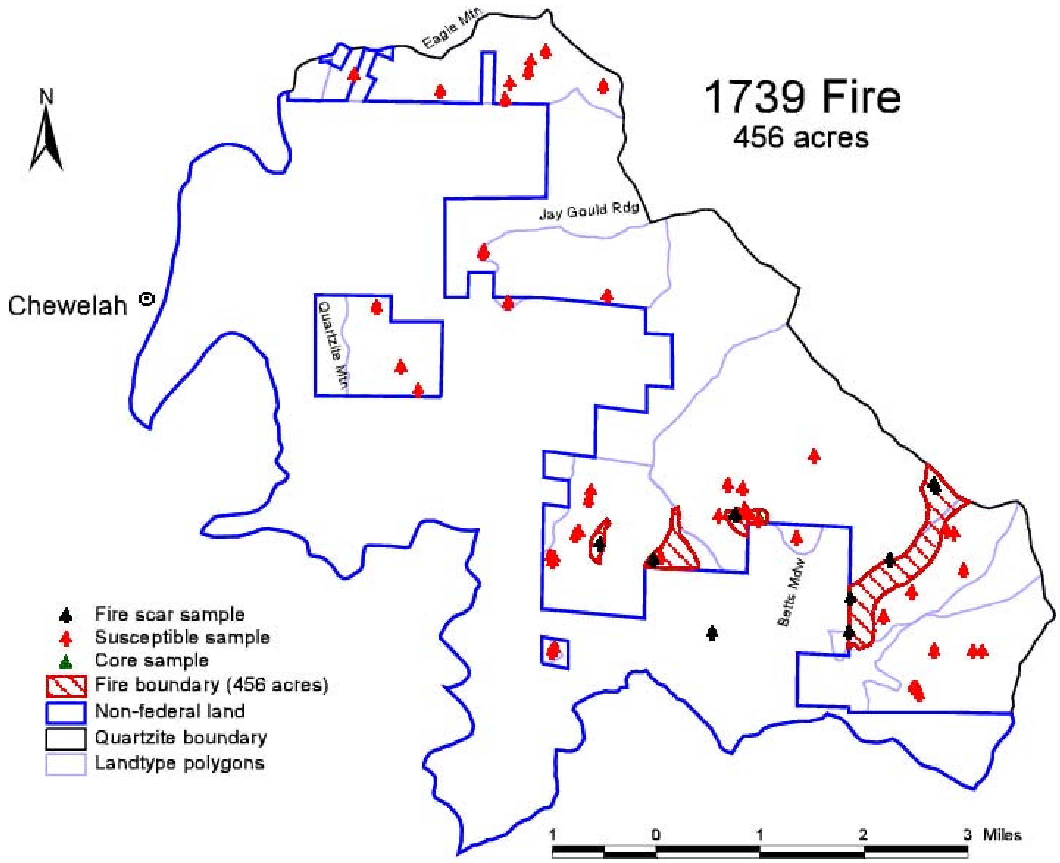

1747 Fire
468 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (468 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

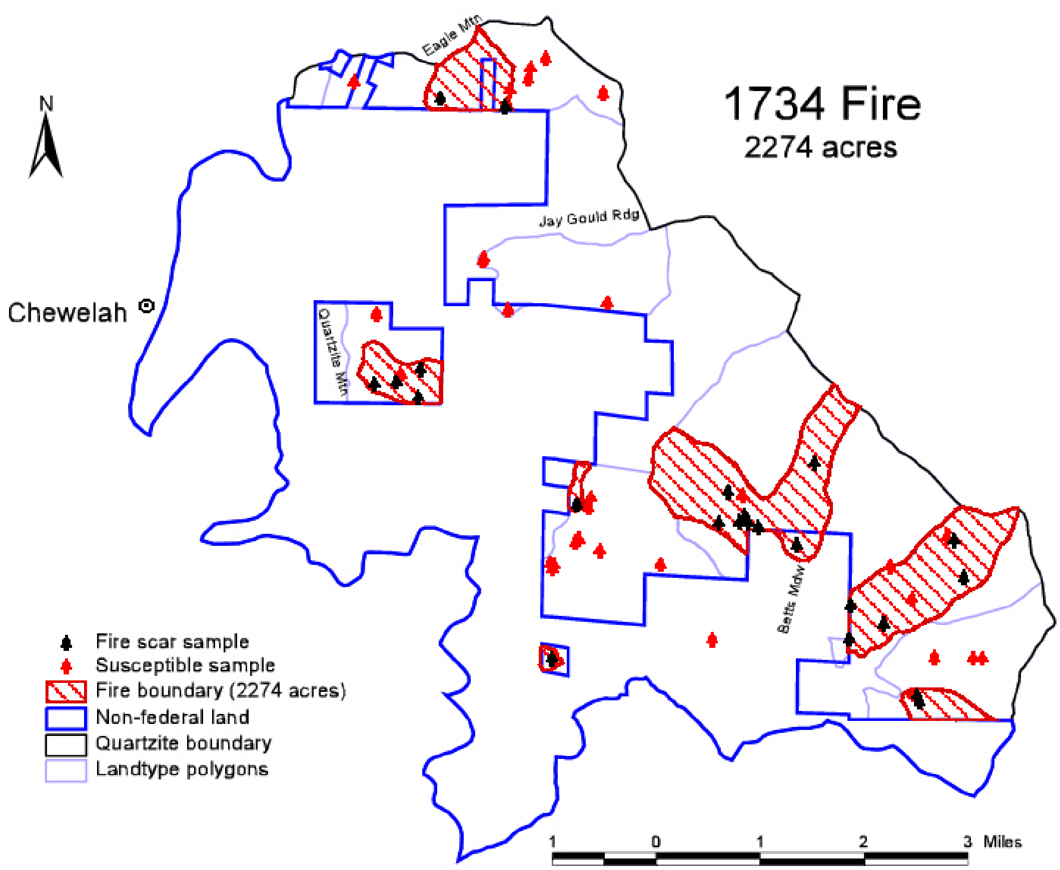


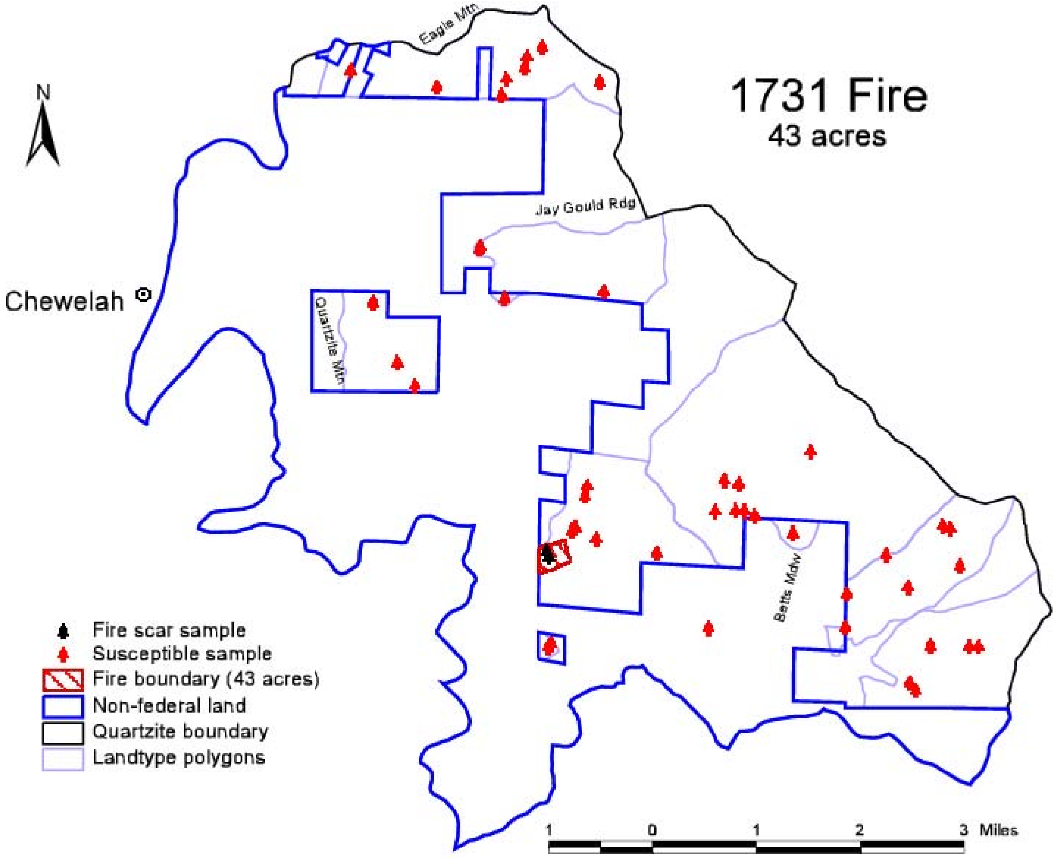
1743 Fire
663 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (663 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

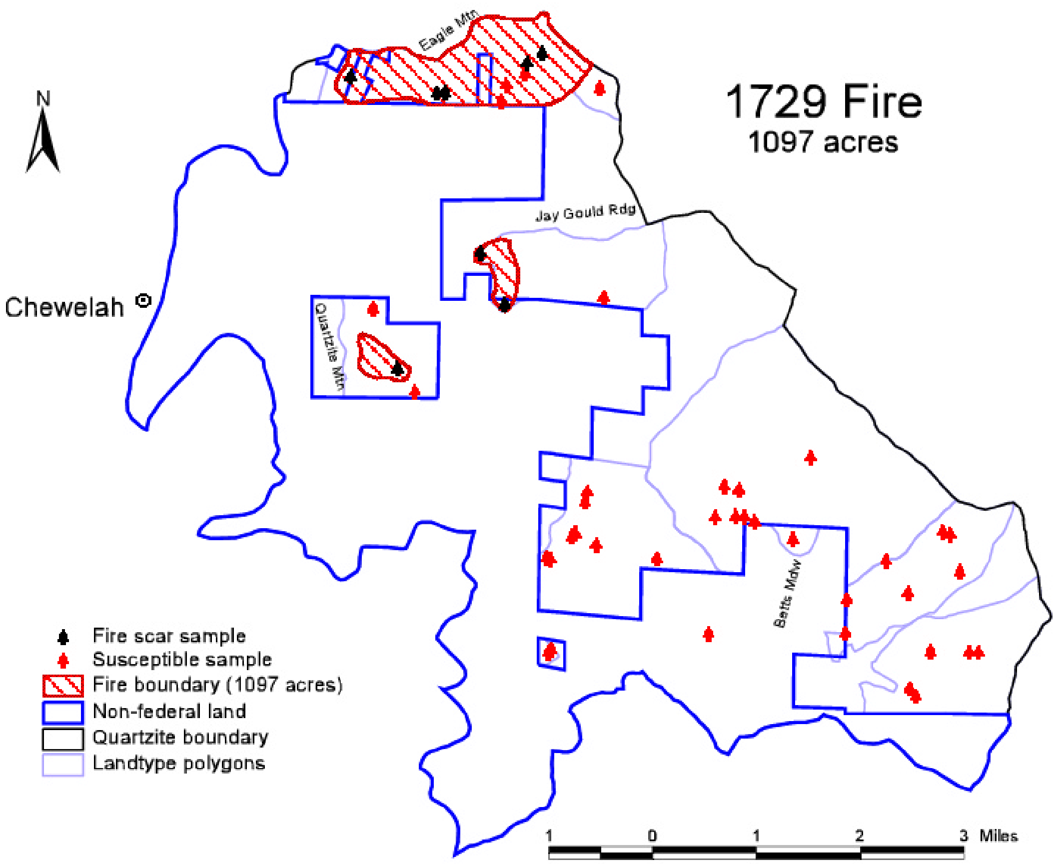


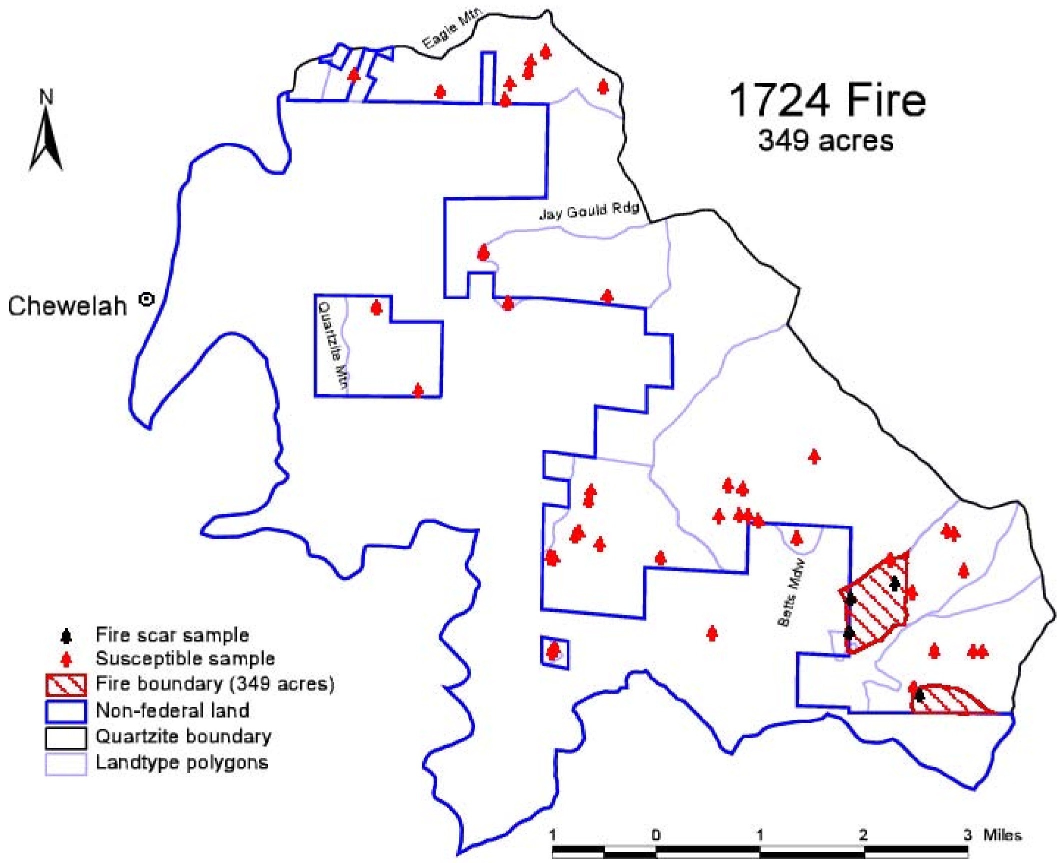
1741 Fire
660 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (660 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

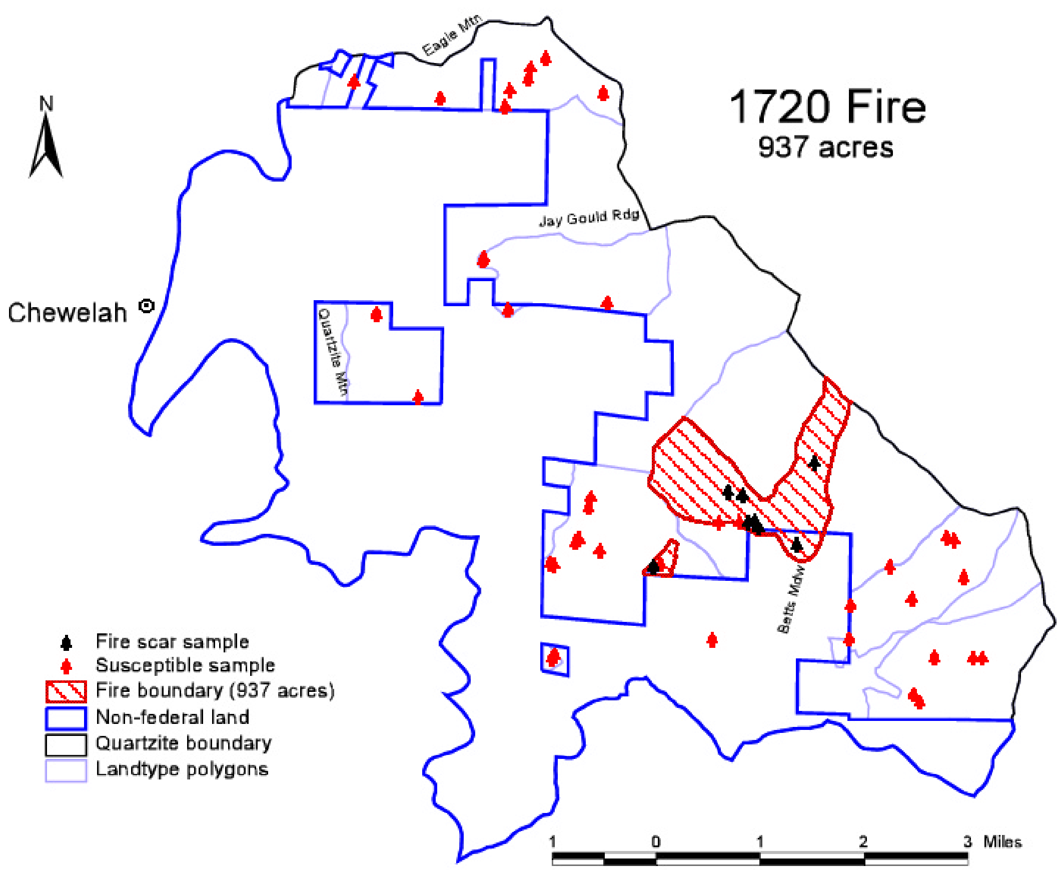

1739 Fire
456 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (456 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

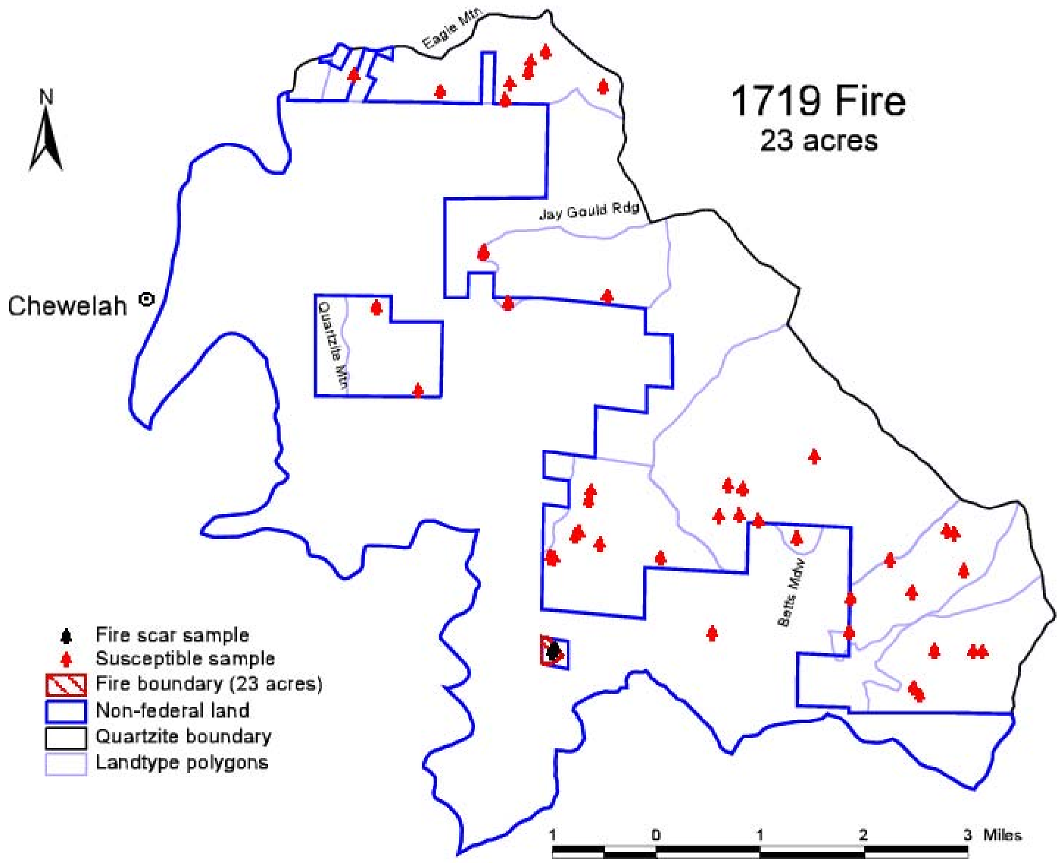

1734 Fire
2274 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (2274 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

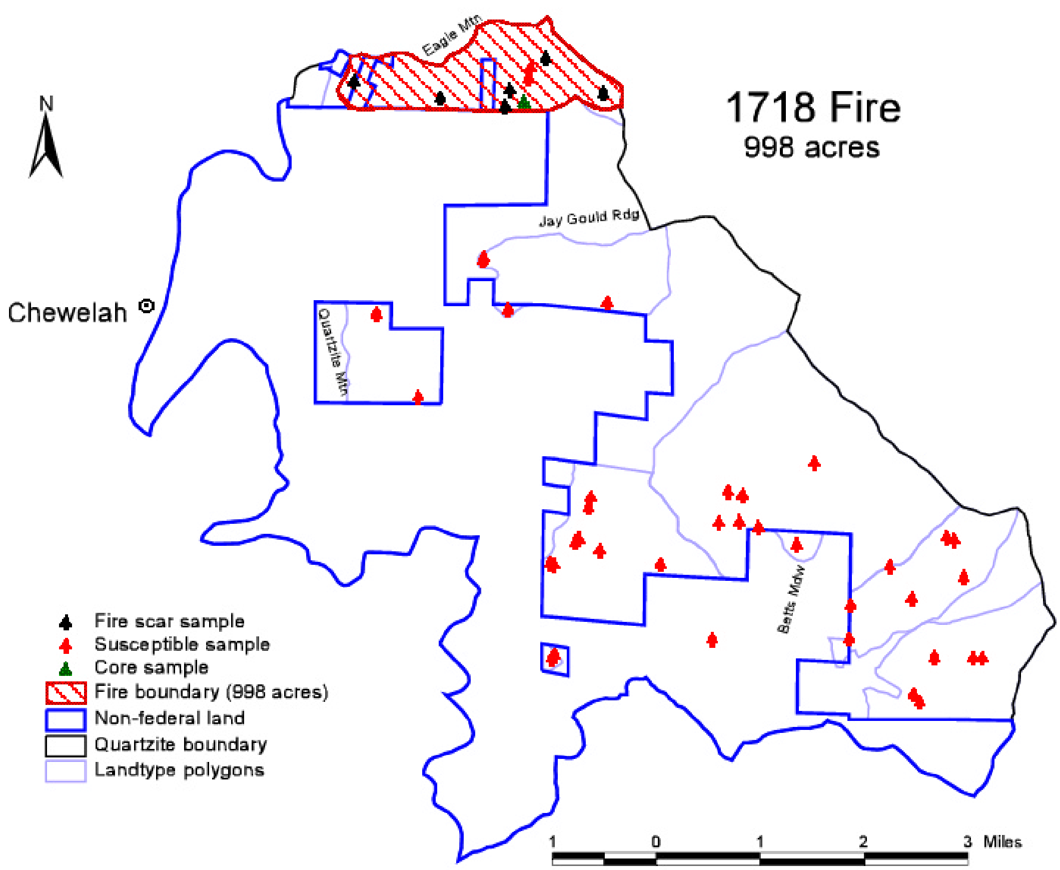

1731 Fire
43 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (43 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

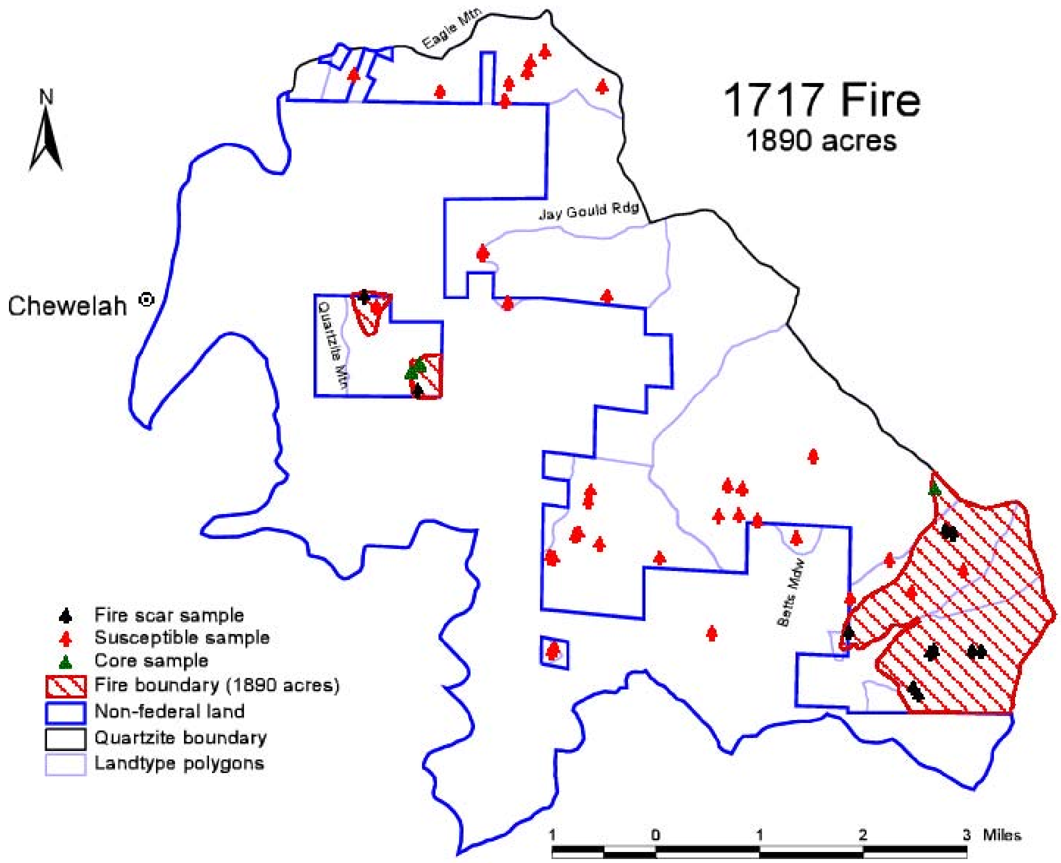

1729 Fire
1097 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (1097 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

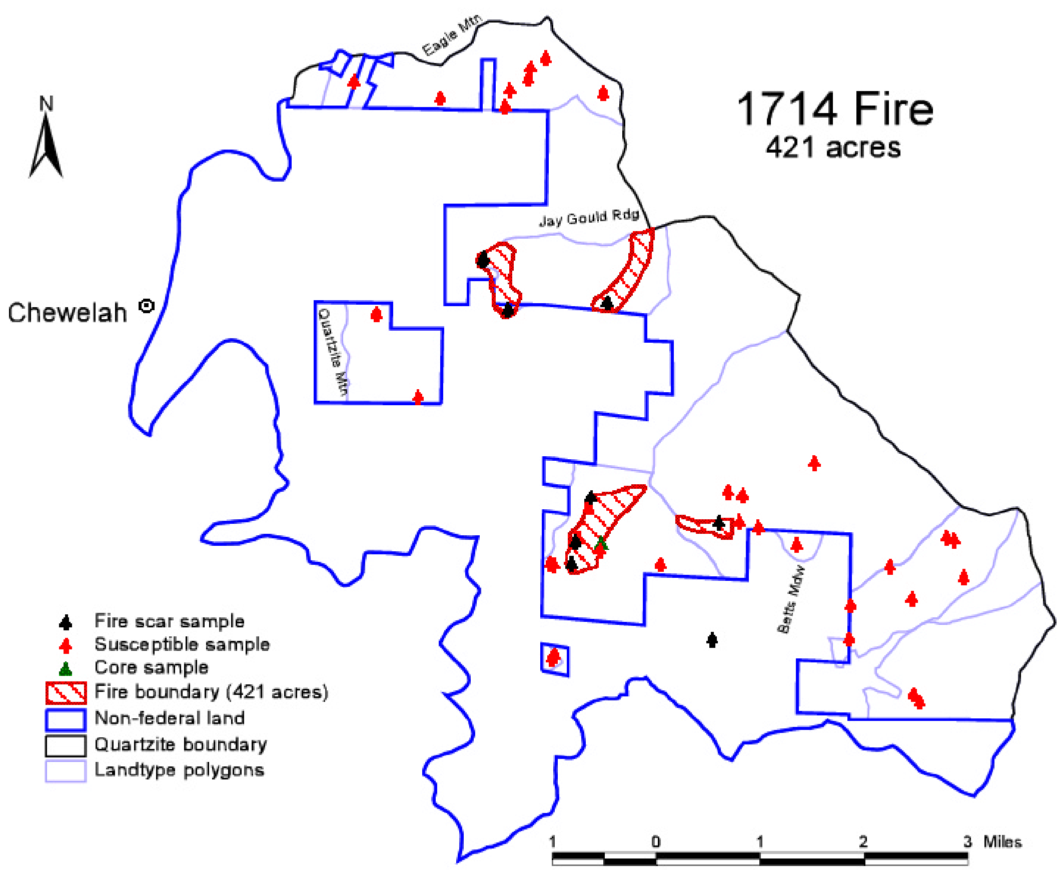

1724 Fire
349 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (349 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

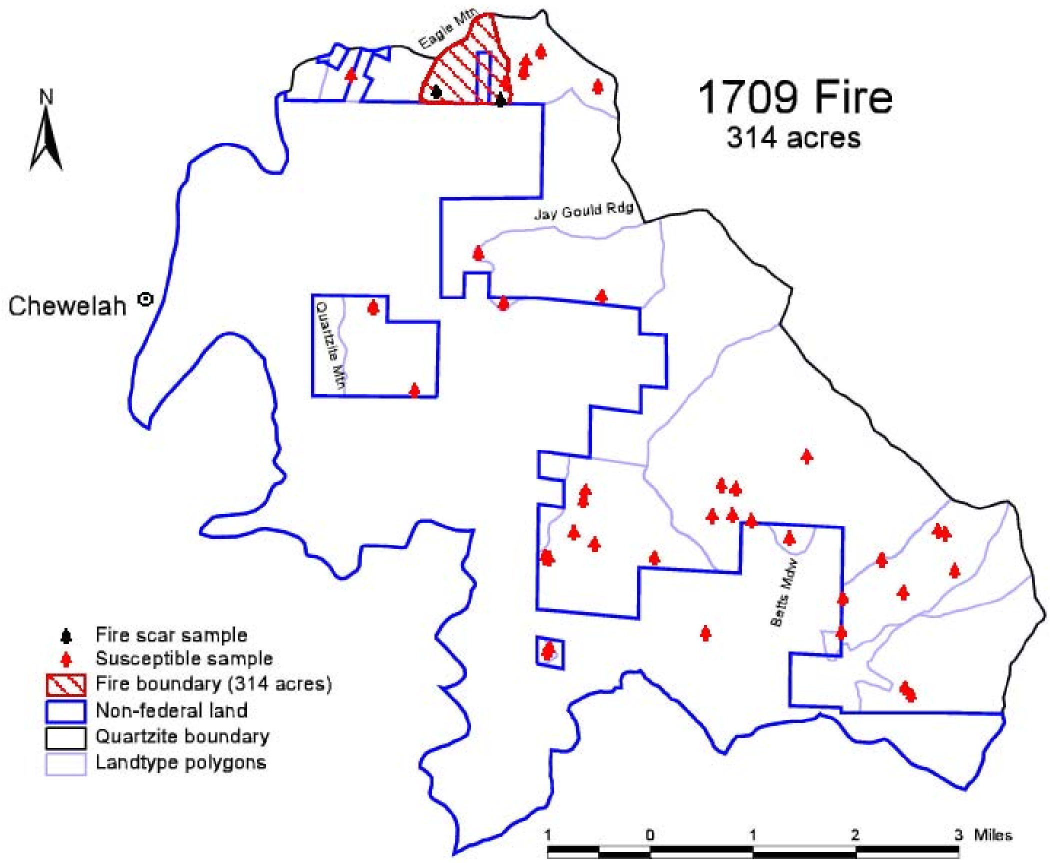

1720 Fire
937 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (937 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

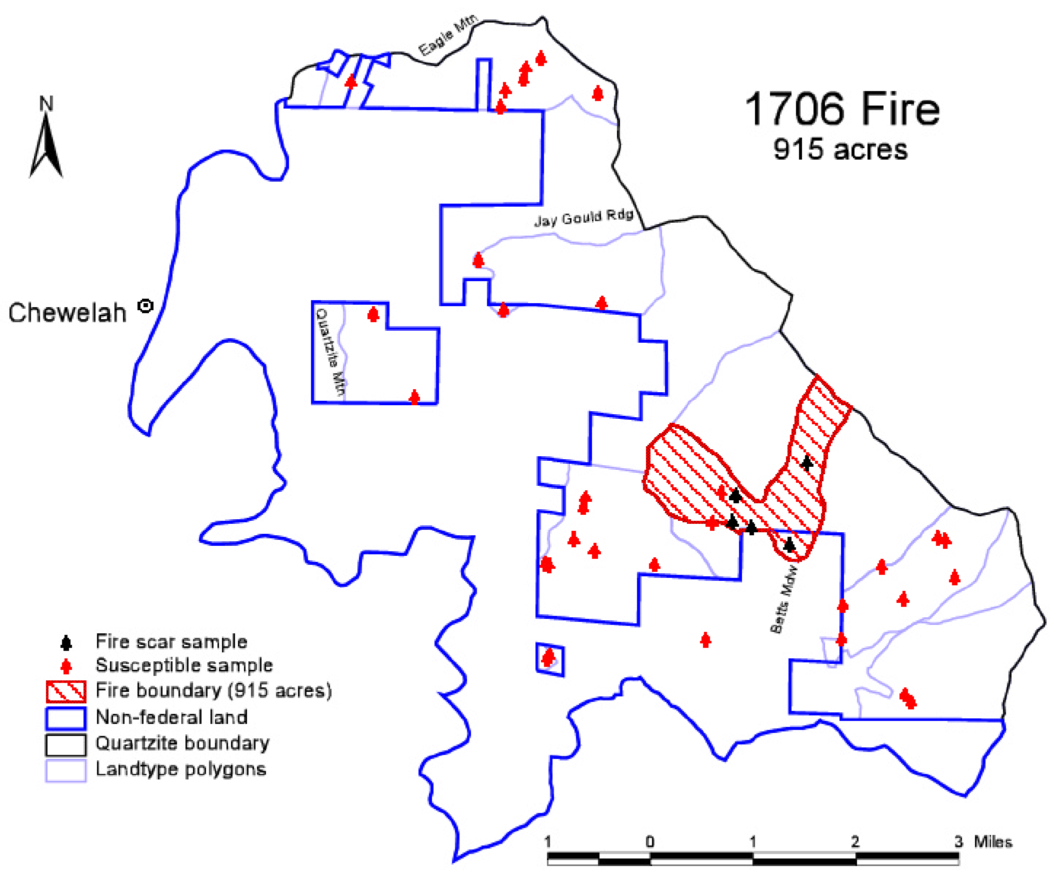

1719 Fire
23 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (23 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles
N

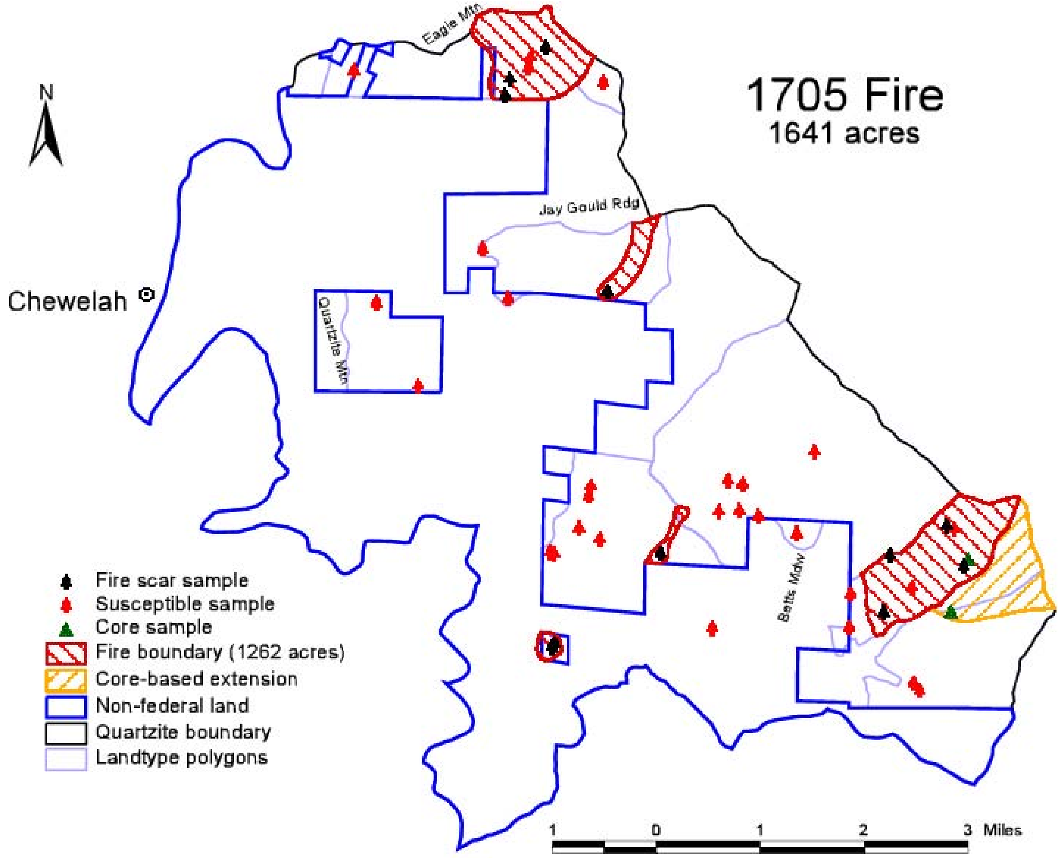

1718 Fire
998 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (998 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles
N

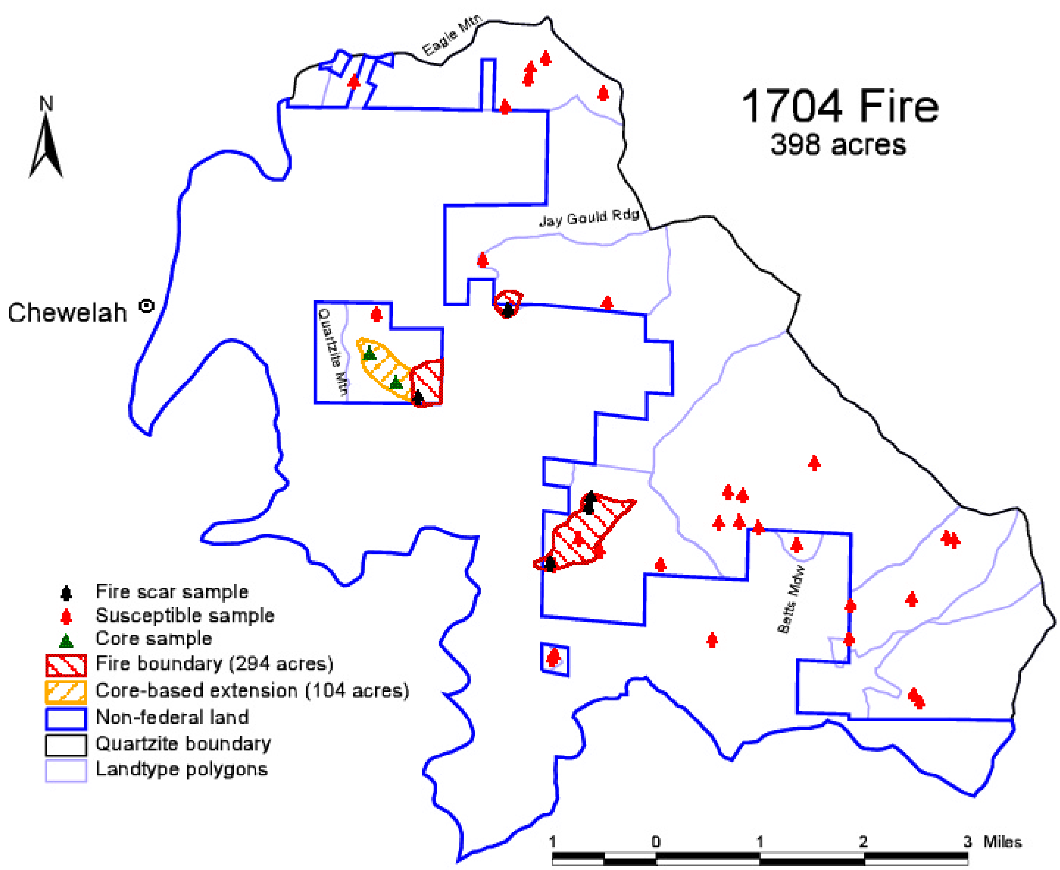

1717 Fire
1890 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1890 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

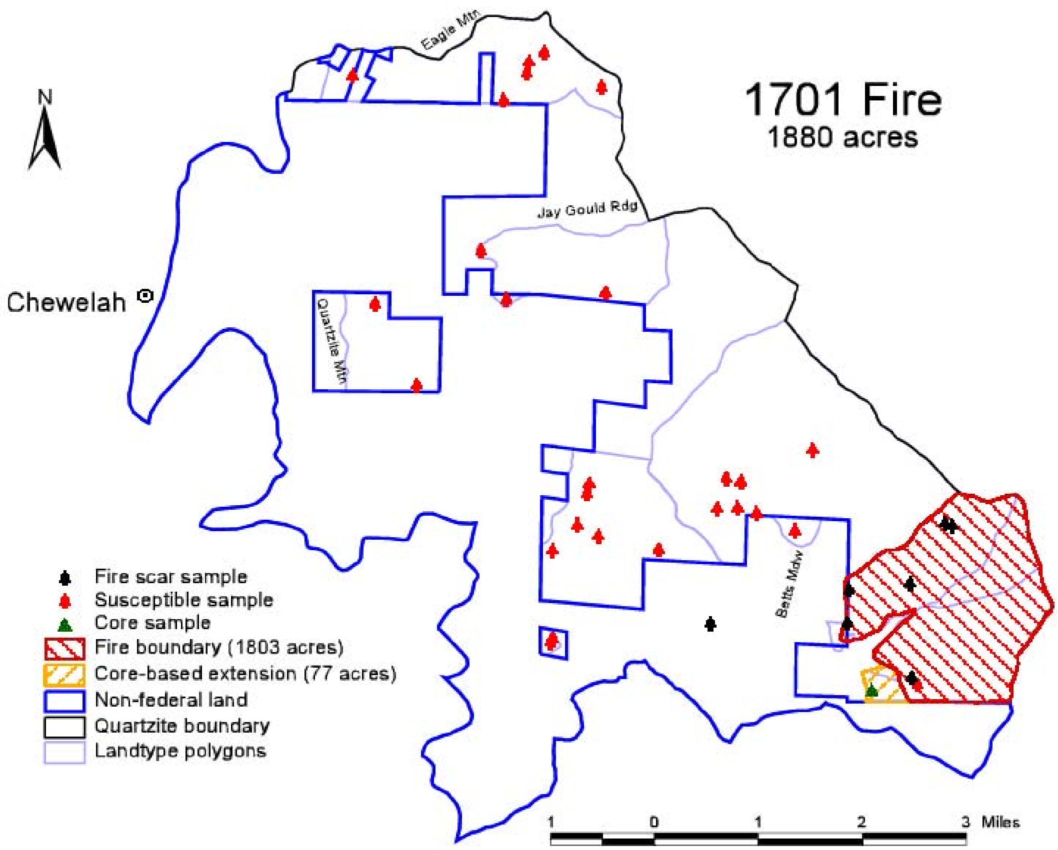

1714 Fire
421 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (421 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

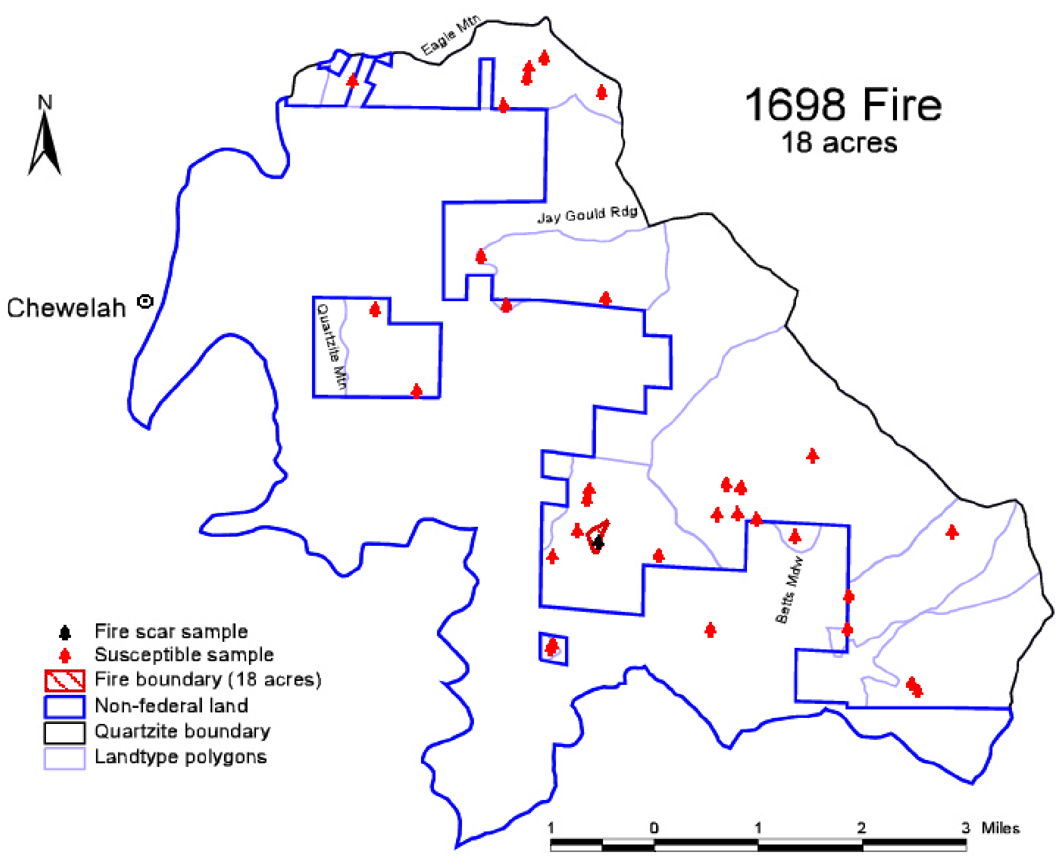

1709 Fire
314 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (314 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

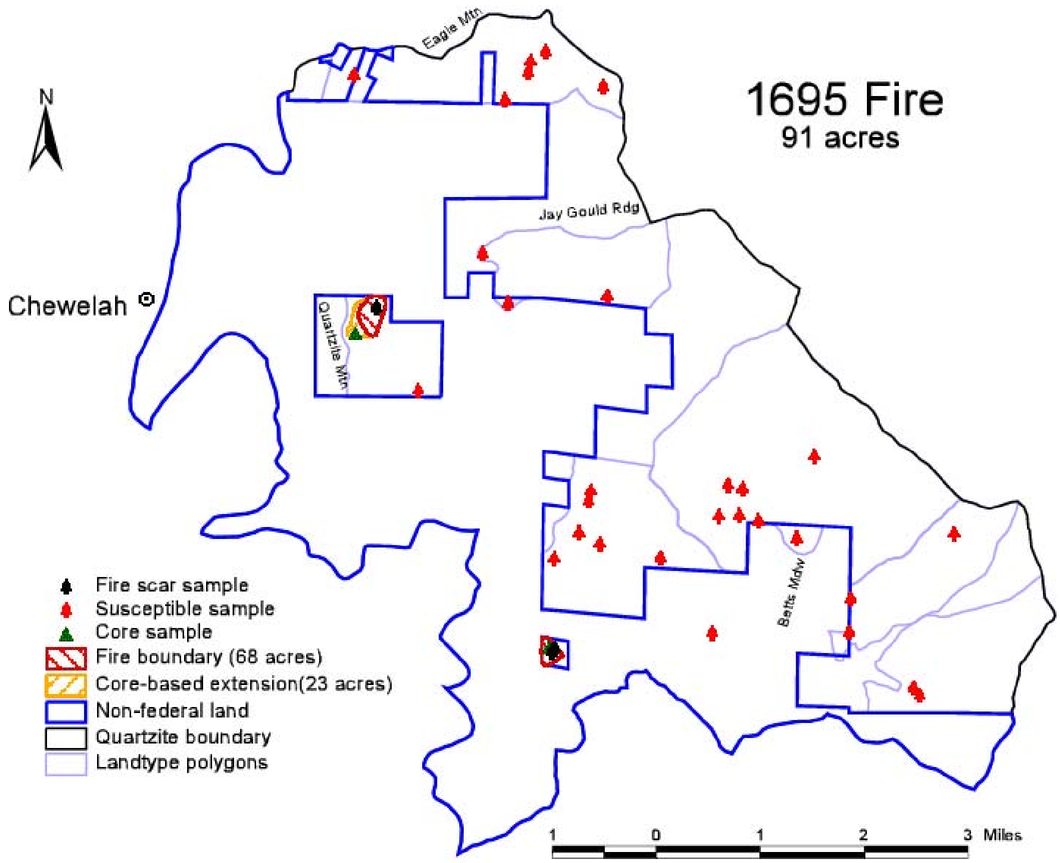

1706 Fire
915 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (915 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

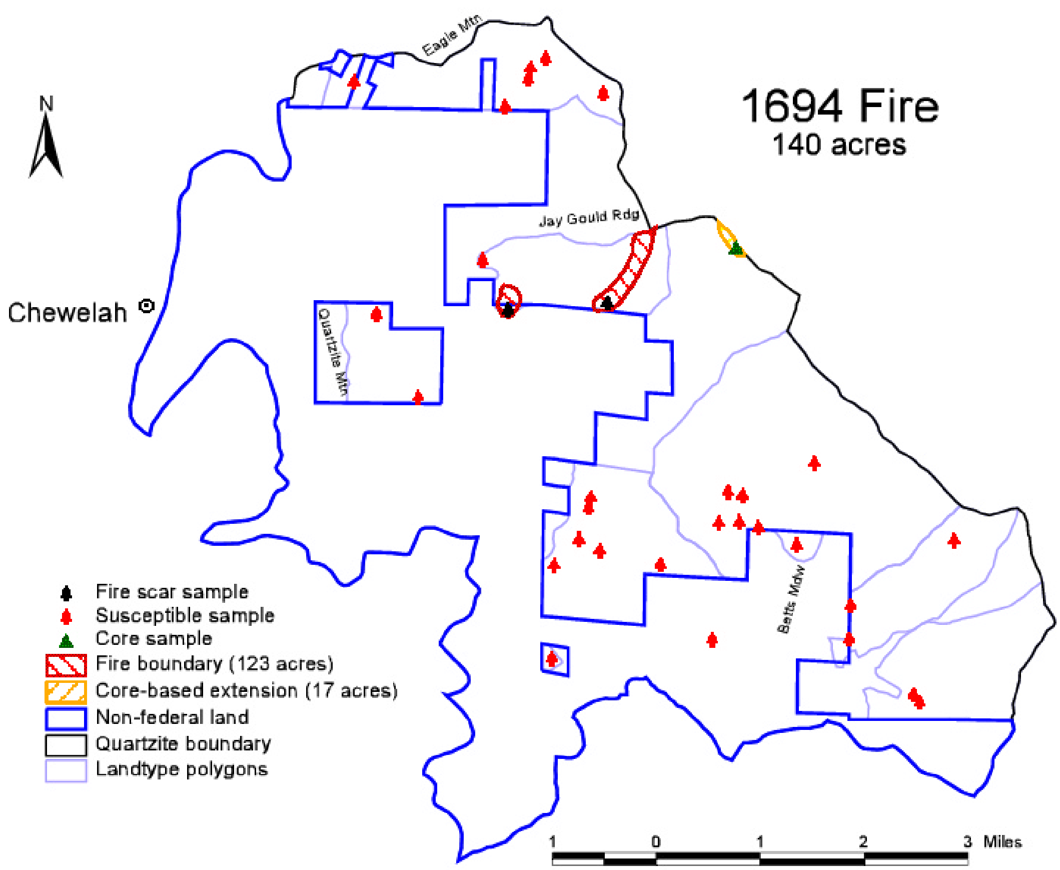

1705 Fire
1641 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1262 acres)
Core-based extension
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

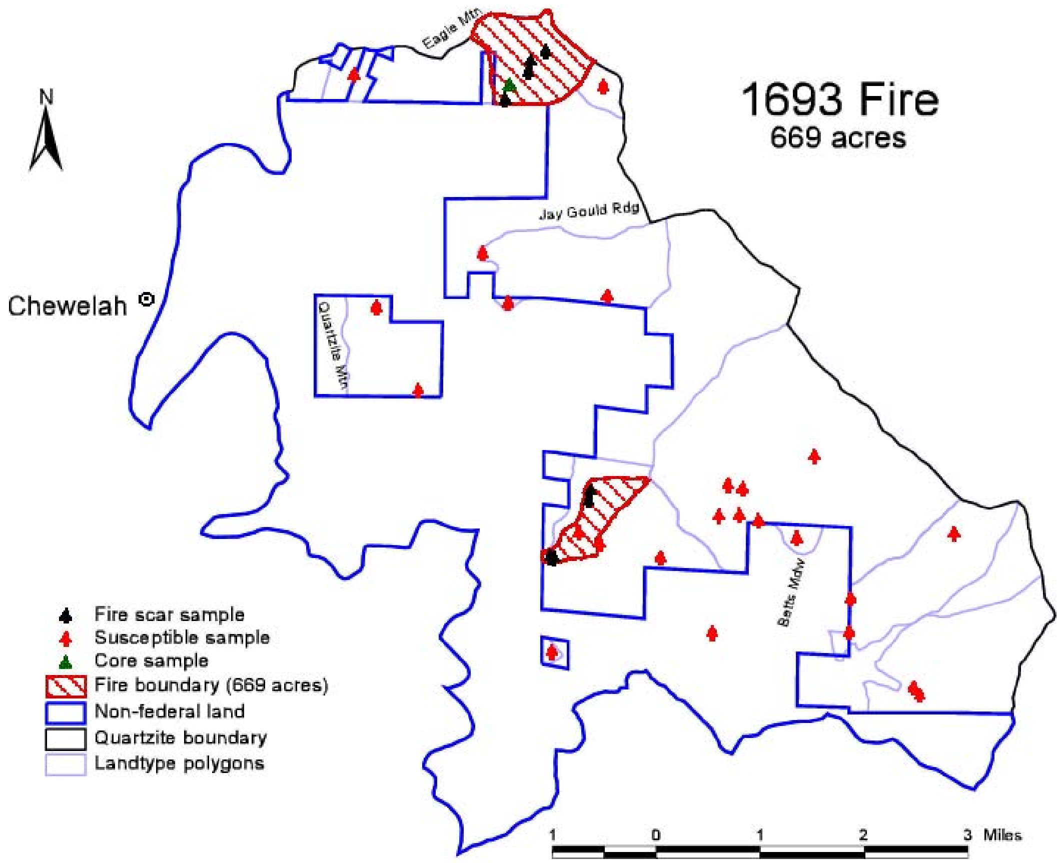

1704 Fire
398 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (294 acres)
Core-based extension (104 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

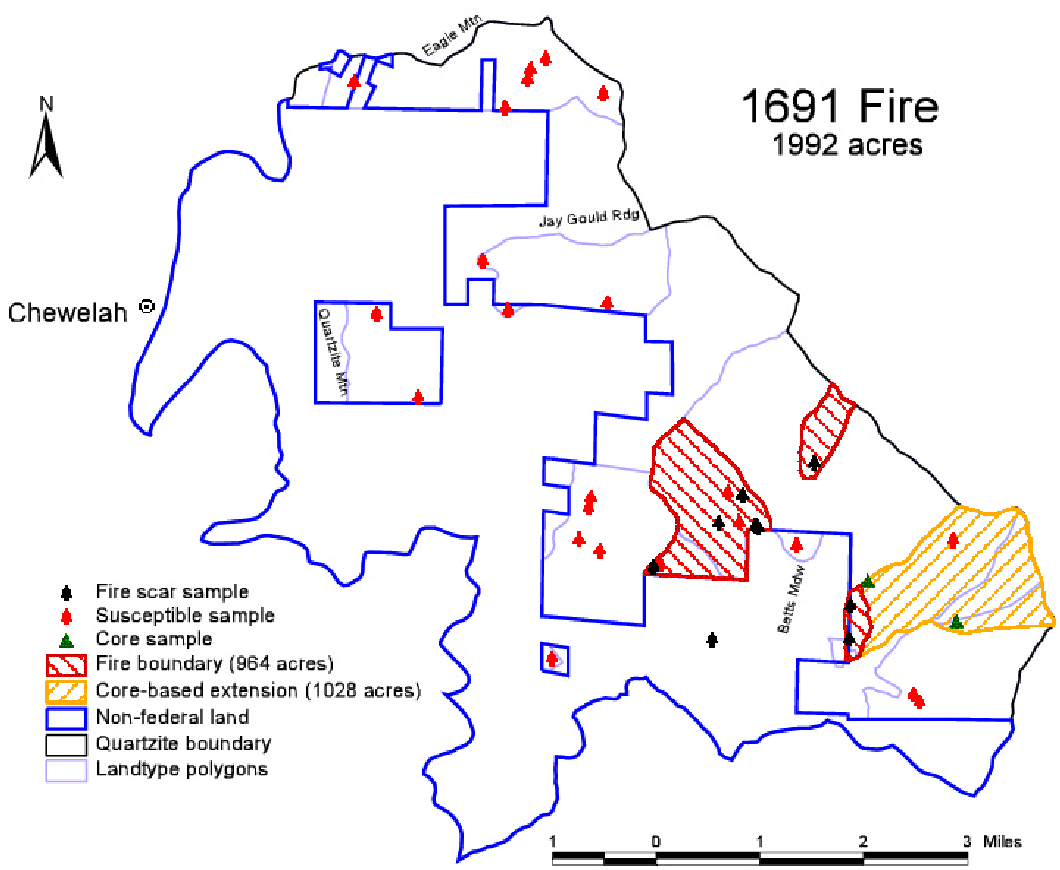

1701 Fire
1880 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1803 acres)
Core-based extension (77 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

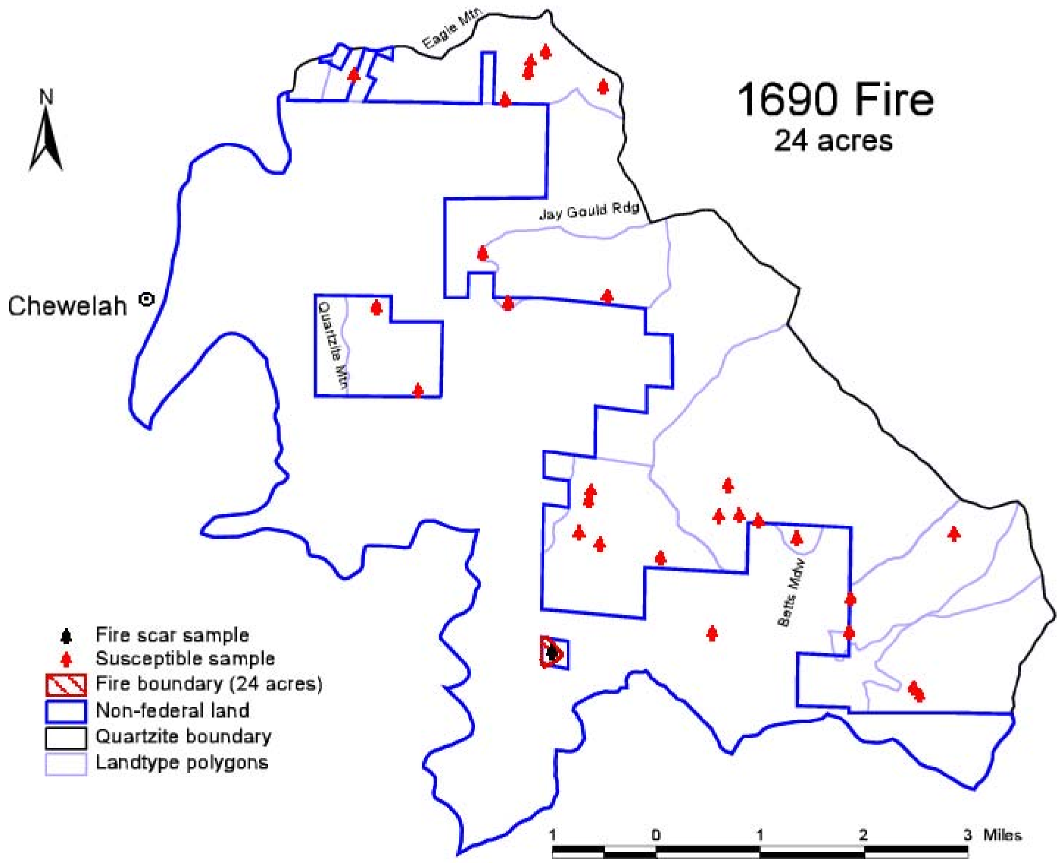

1698 Fire
18 acres
N
Chewelah
Eagle Mtn
Jay Gould Rdg
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (18 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

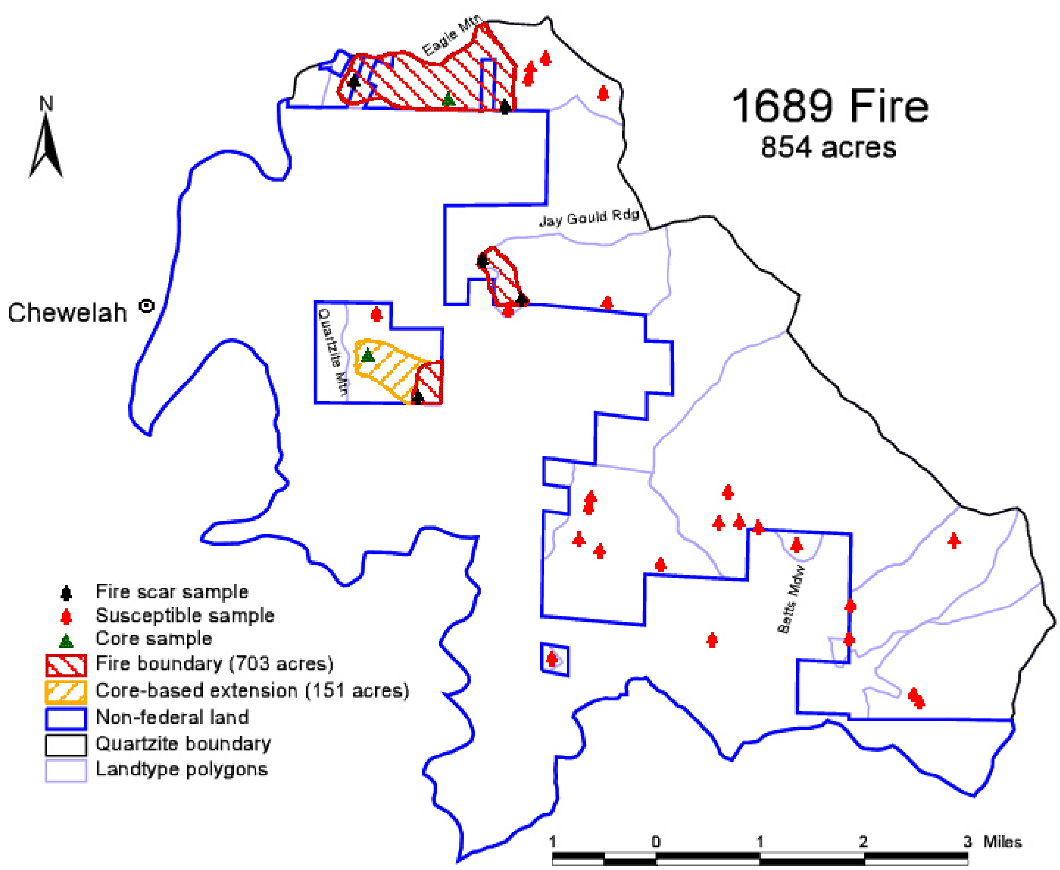

1695 Fire
91 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (68 acres)
Core-based extension(23 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

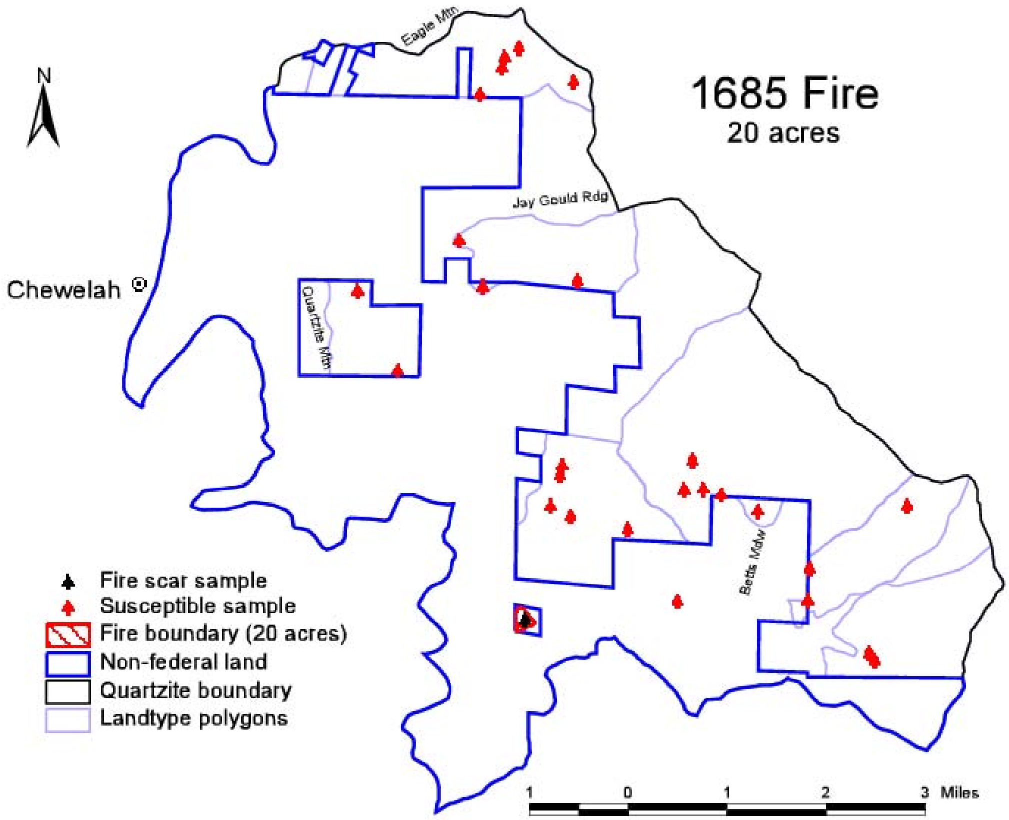

1694 Fire
140 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (123 acres)
Core-based extension (17 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

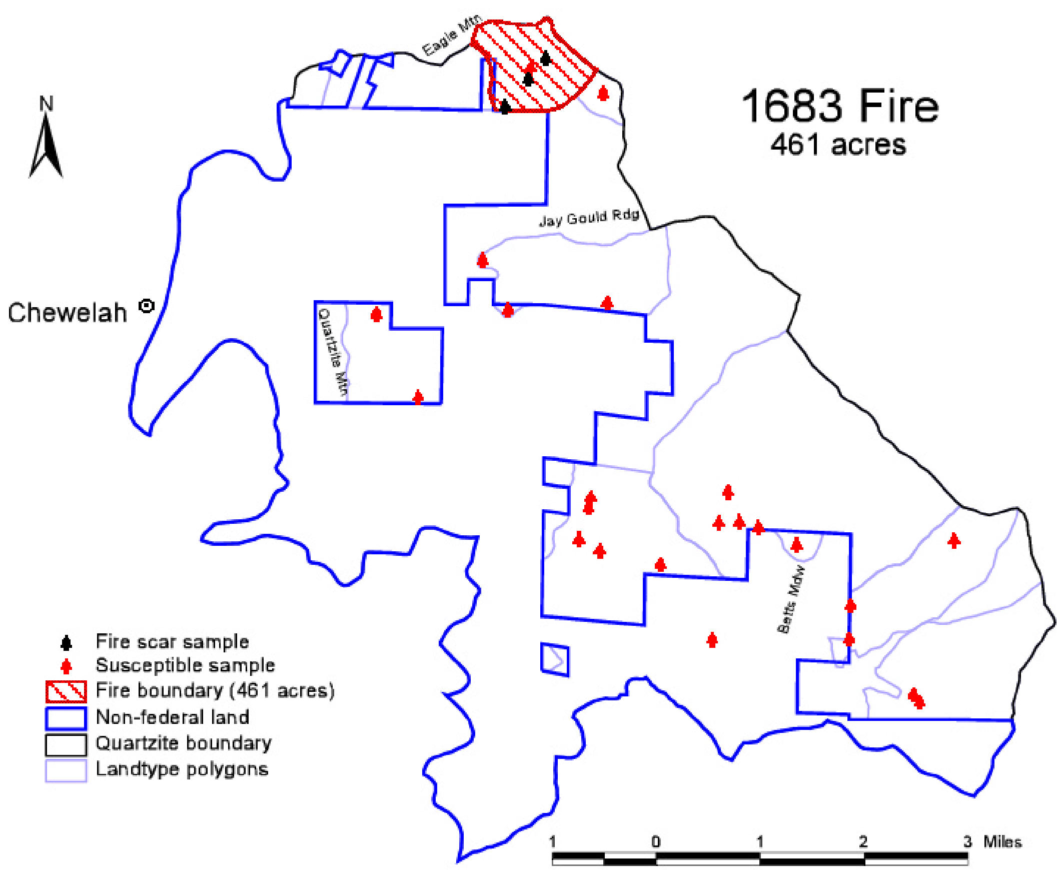

1693 Fire
669 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (669 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

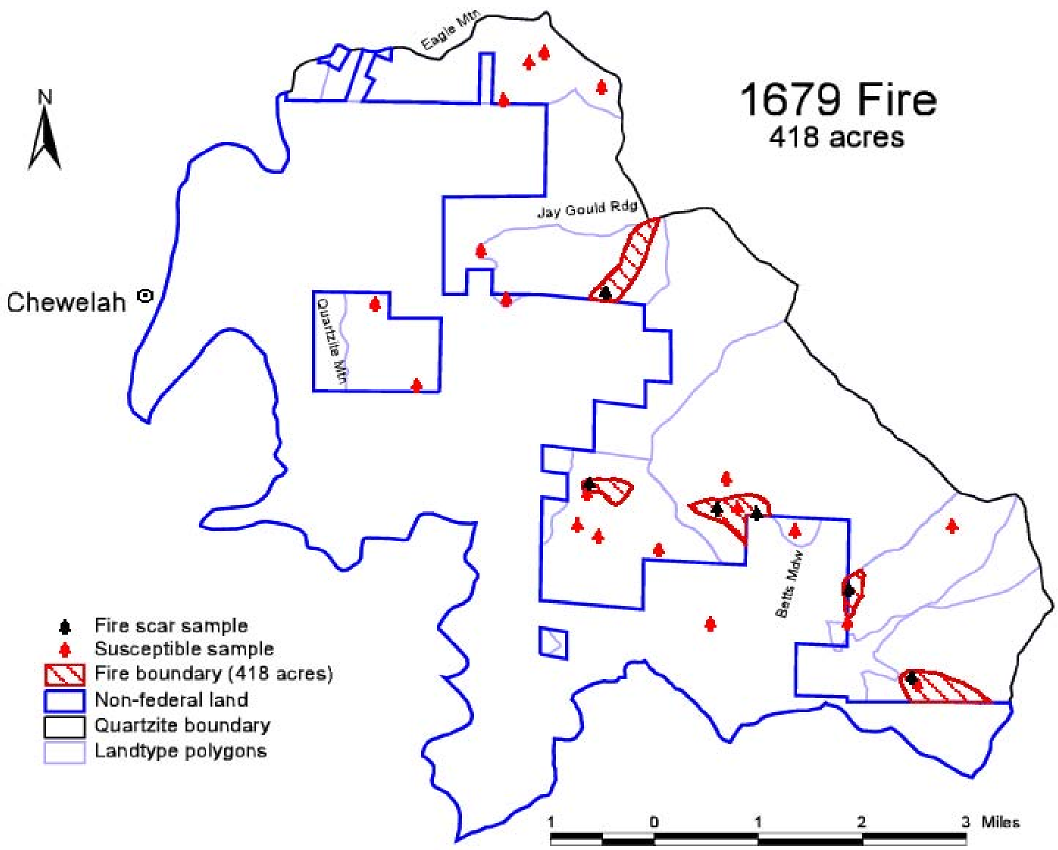

1691 Fire
1992 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (964 acres)
Core-based extension (1028 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles

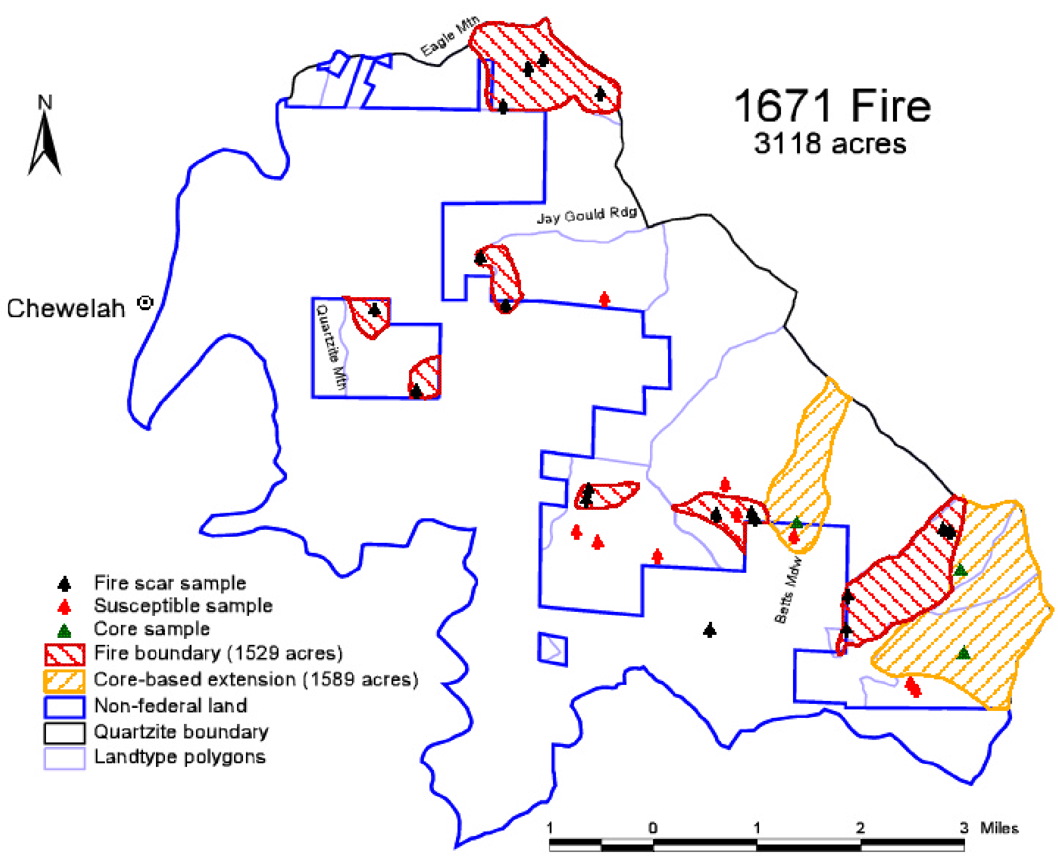

1690 Fire
24 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (24 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1689 Fire
854 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Core sample
Fire boundary (703 acres)
Core-based extension (151 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1685 Fire
20 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (20 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1683 Fire
461 acres
N
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
Fire scar sample
Susceptible sample
Fire boundary (461 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1 0 1 2 3 Miles


1679 Fire
418 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Fire boundary (418 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3 Miles


1671 Fire
3118 acres
Eagle Mtn
Jay Gould Rdg
Chewelah
Quartzite Mtn
Betts Mdw
N
Fire scar sample
Susceptible sample
Core sample
Fire boundary (1529 acres)
Core-based extension (1589 acres)
Non-federal land
Quartzite boundary
Landtype polygons
1
0
1
2
3 Miles